Commission for Communications Regulation
An Coimisiún um Rialáil Cumarsáide

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1. Survey Summary

Address of Transmitter Site Surveyed:	Sleaveen Rd, Macroom, Co. Cork
Survey Date:	29/06/2023
Base Station ID's:	CKE53 / CK0449 / CK_4124 / CK023
Network Operators:	Vodafone / Three / EIR / Imagine
Technologies Measured:	GSM / LTE / NR5G / UMTS
Frequency Bands:	700 / 800 / 900 / 1800 / 2100 / 3600 MHz

Measurement Location: (at point of maximum non-ionising radiation near site, approximate distance from site.)	At farm gate access to telecoms compound, beside antenna location.

	LAT	LONG
Measurement Location Coordinates (decimal):	51.897803	-8.961103

Purpose and Conduct of Survey:

The purpose of this survey was to assess compliance with the limits for general public exposure to non-ionising radiation (**NIR**) set by the International Commission on Non-Ionising Radiation Protection (**ICNIRP) ("ICNIRP Public Exposure Limits")**.

Compliance with the ICNIRP Public Exposure Limits is a condition of a General Authorisation for an electronic communications network/service as well as of various Wireless Telegraphy licences issued by the Commission for Communications Regulation (**ComReg**).

The survey was conducted by:

- measuring the overall electromagnetic field (**EMF**) present at the point of highest exposure in a public area associated with the designated transmitter site;
- identifying the frequency of the principal emissions contributing to the EMF; and
- measuring the intensity (or level) of same.

Overall Conclusions of the Survey	
Frequency Selective Measurements: (Individual emissions measured at specific frequencies)	**Below ICNIRP Public Exposure Limits [Compliant]**
Total Exposure Quotient: (Assessment of cumulative emissions from multiple transmitters)	**Below ICNIRP Public Exposure Limits [Compliant]**

2. Surveyors

Survey conducted for ComReg by:	**Compliance Engineering Ireland Ltd.**	COMPLIANCE ENGINEERING IRELAND LTD

Survey Engineer(s):	**Report Writer:**	**Report Reviewer:**
Michael Reilly, BEng	Michael Reilly, BEng	John McAuley, MEng

3. Survey Location Details

Designated Transmitter Site Photo

Survey Weather

Sky: Light Cloud

Temperature:
16° C

Relative Humidity:
47 %

Map(s) of Designated Transmitter Site and Measurement Location (Checks and Final)

Initial measurement point check readings: (approximate)	1. 1.35 V/m 2. 0.83 V/m 3. 0.61 V/m

4. Introductory Note

Purpose of Survey

The survey of the designated transmitter site (**"Designated Site"**) was commissioned by ComReg as part of its Programme of Measurement of Non-Ionising Radiation. The purpose of the survey was to assess whether NIR (occurring within the radio frequency part of the electromagnetic spectrum) from the Designated Site complied with the limits for general public exposure specified in the guidelines published by ICNIRP ("**ICNIRP Public Exposure Limits"**).[1] Compliance with the ICNIRP Public Exposure Limits is a condition of a General Authorisation for the provision of an electronic communications network/service (e.g. mobile phone and broadcasting networks) as well as of various Wireless Telegraphy licences (in respect of transmitting stations) issued by ComReg.

Survey Methodology

Measurements of the NIR from the Designated Site were conducted in accordance with the methodology outlined in ComReg Document 08/51R3[2]. Once standardised, these methodologies are to be incorporated. Methodologies used in conducting this site reports are listed below;

- European Electronic Communications Committee (**ECC**) Recommendation (02)04[3];
- European Committee for Electrotechnical Standardisation (**CENELEC**) measurement standard EN 50492:2008[4], and
- Measurement techniques developed by the Institut für Mobil- und Satellitenfunktechnik (**IMST**) and the EM-Institut on behalf of the German Federal Office for Radiation Protection.[5]

Additional methodologies to be used in conducting this site report are listed below:

- Measurement techniques as published by Dr. Helmut Keller on behalf of Narda Safety Test Solutions.[6]

Note re this Report Version

If you have downloaded this report from ComReg's Siteviewer[7] or from www.comreg.ie, you are reading an abbreviated version. The full technical version of this report also contains a comprehensive technical record of the measurements and any calculations performed, a list of equipment used, and a technical appendix. A copy of the full report is available upon request from ComReg.

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[1] Current ICNIRP guidelines:

- *"Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz)",* ICNIRP, published in 'Health Physics', March 2020, Volume 118, No. 5: https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf
- *"Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz to 100 kHz)",* ICNIRP, published in 'Health Physics', December 2010, Volume 99, No. 6: https://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf

[2] https://www.comreg.ie/publication-download/programme-of-measurement-of-non-ionising-radiation-emissions-methodology-for-the-conduct-of-surveys-to-measure-non-ionising-electromagnetic-radiation-from-transmitter-sites-2

[3] ECC RECOMMENDATION (02)04, *"Measuring Non-Ionising Electromagnetic Radiation (9 kHz – 300 GHz)"*, ECC, (revised Bratislava 2003, Helsinki 2007): http://www.erodocdb.dk/Docs/doc98/official/pdf/REC0204.PDF

[4] EN 50492:2008, *"Basic standard for the in-situ measurement of electromagnetic field strength related to human exposure in the vicinity of base stations"*, CENELEC, November 2008: http://www.cenelec.eu

[5] See: http://www.bfs.de .

[6] *"On the Assessment of Human Exposure to Electromagnetic Fields Transmitted by 5G NR Base Stations", published in 'Health Physics', November 2019 Volume 117, No.5: https://journals.lww.com/health-physics/fulltext/2019/11000/on_the_assessment_of_human_exposure_to.7.aspx*

7 https://siteviewer.comreg.ie/

5. Survey Overview

Survey Stages

In accordance with the methodology outlined in ComReg Document 08/51R4, this survey was conducted in three stages:

1. **Initial Site Survey**
2. **Full Survey – Broadband Measurements**
3. **Full Survey – Frequency Selective Measurements**

An outline of each stage, along with the results and conclusions of the measurements, are presented in the following three sections.

Measurement of Electromagnetic Fields

Electromagnetic fields (**EMFs**) can be sub-divided into two components:

- Electric field (**E-field**) (measured in volts per metre or "V/m"]; and
- Magnetic field (**H-field)** (measured in amperes per metre or "A/m"].

The E-field and the H-field are mathematically interdependent[8] in the **radiating near-field**[9] and the **far-field[10],** which are located before and beyond a distance of at least the wavelength of the radiated EMF respectively. The measurement locations for most transmitter installations lie well within the far-field, as the wavelengths of the transmitted signals are relatively short, and the antennas are typically located many metres from any public area.

The following table gives examples of wavelengths for some commonly transmitted signals:

Transmitter Type	Frequency	Wavelength
PMR Low Band VHF	68 MHz	4.41 m
UHF TV	470 MHz	0.64 m
GSM 900 (2G mobile base station)	925 MHz	0.32 m
LTE 1800 (4G mobile base station)	1805 MHz	0.17 m
UMTS (3G mobile base station)	2110 MHz	0.14 m
5G NR (5G Mobile base station)	3500 MHz	0.09 m

In the radiating near-field and far-field, only one component needs to be measured, as the other component can be readily derived from it. Normally, it is the E-field which is measured.

In the case of transmitters of very long wavelength signals, such as long wave radio (1.19 km wavelength), the H-field and E-field must be measured separately as the point of measurement will most likely lie within the **reactive near-field**[11] region. In this region, located within a distance of at least the wavelength of the radiated EMF, the relationship between E and H becomes very complex and there is no direct correlation between both components of the EMF.

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[8] $E \approx H \times Z_0$ (Radiating Near Field) and $E = H \times Z_0$ (Far Field), where Z_0 (characteristic impedance of free space) $\approx 377\ \Omega$

[9] Beyond a distance of max(λ, D, $D^2/4\lambda$), where λ is the wavelength and D is the antenna's largest dimension

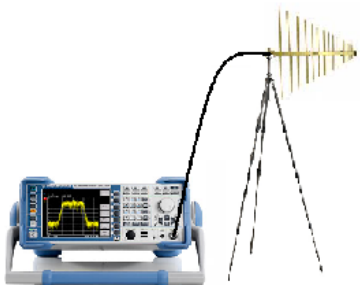
[10] Beyond a distance of max(5λ, 5D, $0.6D^2/\lambda$)

[11] Within a distance of max (λ, D, $D^2/4\lambda$)

Measurement Equipment

The measurement of EMFs is a complex process which involves the use of various meters, spectrum analysers, probes and antennas, appropriate to the frequencies of the emissions being measured.

The table below shows examples of equipment typically used to measure EMFs in NIR surveys.

<table>
<tr><th>Initial Site Survey and Broadband Measurements</th><th colspan="2">Frequency Selective Measurements</th></tr>
<tr><td> 
</td><td colspan="2">SPECTRUM ANALYSER WITH TRIPOD MOUNTED ANTENNA CONNECTED
 
PORTABLE SPECTRUM ANALYSER WITH ANTENNA DIRECTLY CONNECTED
  </td></tr>
<tr><td>Used to measure the overall electric or magnetic field present over a range of frequencies (e.g. 100kHz to 3GHz).</td><td colspan="2">Spectrum analysers are used to measure individual emissions at specific frequencies. Individual emissions contribute to the overall EMF. Examples of individual emissions are a TV signal, and a mobile phone signal for a particular mobile operator. There may be a number of emissions from different transmitters contributing to the overall EMF at a particular location.</td></tr>
</table>

6. Initial Site Survey

An initial survey was carried out in the area around the Designated Site in order to determine the point of maximum NIR. This is the location at which the overall E-field strength level measured was somewhat higher than that measured in other areas around the site and represents the highest level of exposure to which a member of the general public might be subjected in the vicinity of the transmitter.

For this initial survey a calibrated field strength meter fitted with a **3 GHz isotropic probe** was used. The meter and probe were used to measure the sum of all electrical fields present at **all frequencies from 100 kHz up to 3 GHz**.

Once the point of maximum NIR was determined, broadband and frequency-selective measurements were conducted at that location (see following two sections). For the duration of those measurements, the various instruments, antennas and probes used were mounted on non-metallic supports.

7. Full Survey – Broadband Measurements

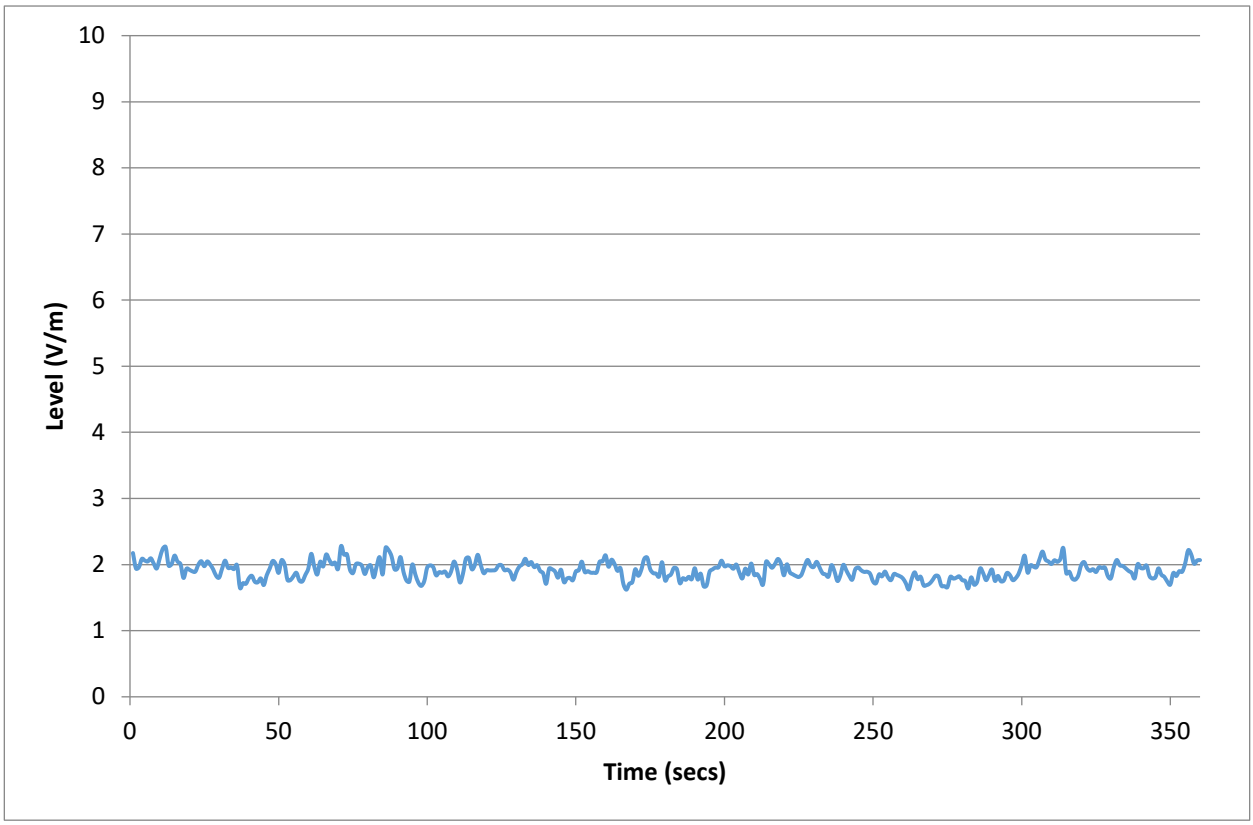
The purpose of these measurements was to get an overview of the intensity of the EMF present at the point of maximum NIR near the Designated Site.

There, the field strength meter (which was mounted on a tripod and fitted with **3GHz isotropic probe)**, was set to record, over a six-minute period, simultaneous measurements of the sum of all received signals within the frequency range of the probe. This measurement was then repeated using a **40 GHz isotropic probe**.

The broadband measurement results presented below show the levels in volts per metre (V/m) recorded during the six-minute period. The average and maximum levels can be compared to the lowest maximum ICNIRP Public Exposure Limits which is 27.7 V/m.

If a broadband measurement is higher than 27.7 V/m, it does not necessarily follow that the ICNIRP Public Exposure Limits have been exceeded because the limits are frequency dependent. A more detailed investigation involving frequency selective measurement is necessary to assess compliance with the ICNIRP Public Exposure Limits (see following section).

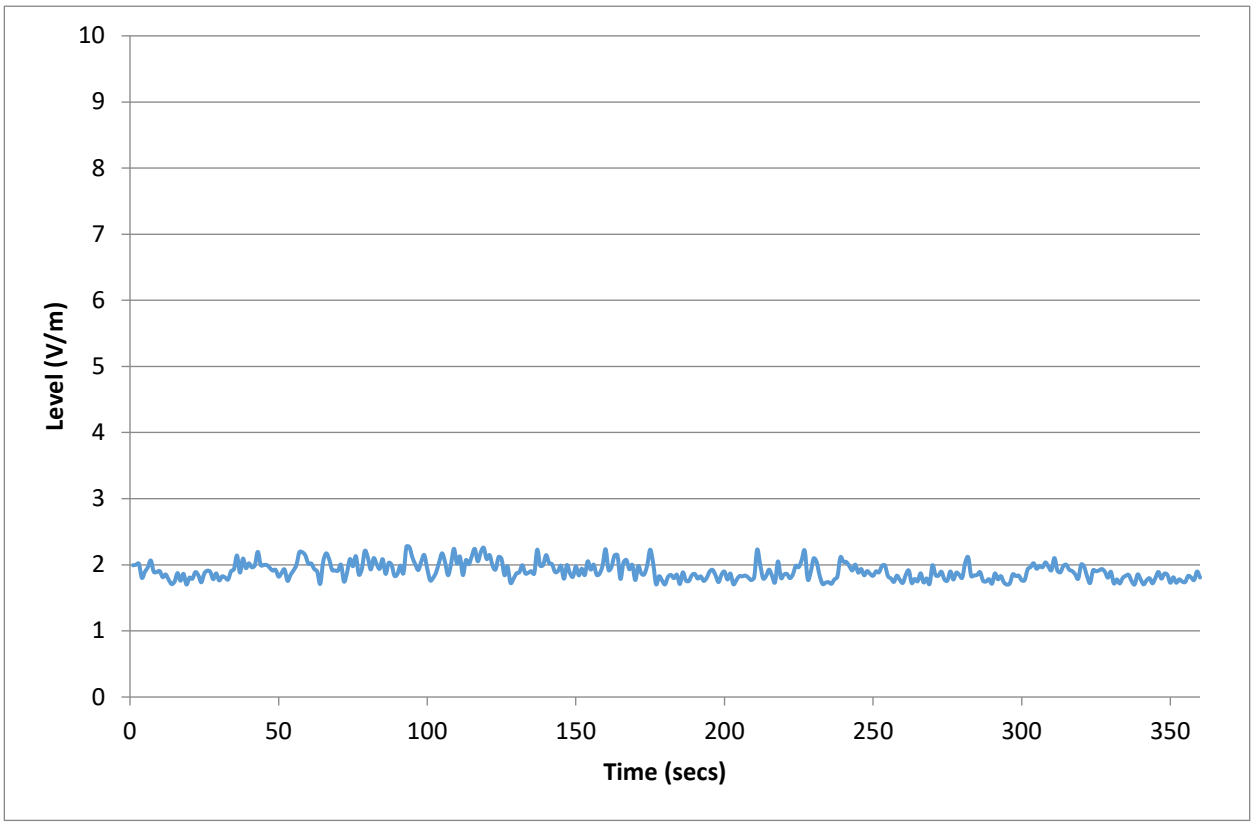
Electric field strengths recorded over 6-minute period using 3 GHz probe at point of maximum NIR



Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	1.91 V/m	**Peak Measurement V/m:**	2.28 V/m
Date:	29/06/2023	**Start Time:**	10:30
Meter:	NBM-550	**Probe:**	EF3091
Frequency Range:	100 kHz – 3 GHz		

Electric field strengths recorded over 6 min period using 40 GHz probe at point of maximum NIR



Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	1.90 V/m	**Peak Measurement V/m:**	2.27 V/m
Date:	29/06/2023	**Start Time:**	10:39
Meter:	NBM-550	**Probe:**	EF 4091
Frequency Range:	27 MHz – 40 GHz		

Conclusion of the Broadband Measurements

The mean and peak measurements were below the lowest ICNIRP guideline limit of 27.7 V/m.

8. Full Survey – Frequency Selective Measurements

Basic Measurement Procedure

A more detailed survey was performed at the point of maximum NIR near the Designated Site to identify the individual transmit frequencies and field strengths of each type of emission - e.g. mobile (GSM, UMTS, LTE and 5G NR), wireless broadband (BWA), television (DVB-T), FM radio - and their contribution to the total EMF.

The measurements were performed using spectrum analyser equipment and a range of antennas to match the frequency bands in which emissions were measured.

Table of Measurement Results

A list of the measurements made is presented in the table on the following page. For each emission measured, the table shows:

- **Emission Type** (e.g. GSM, UMTS, LTE, 5G NR, DVB-T etc);
- Transmission **frequency** of the signal;
- **Measured Level** (in volts per metre (V/m));
- **Adjusted Level** (if applicable to account for the characteristics of certain signal types or to compensate for limitations of measurement equipment or to estimate emissions for maximum call or data traffic); and
- **ICNIRP Public Limit**.

Further details of Adjusted Level/s and ICNIRP Public Exposure Limits are in the explanatory notes which follow the table of measurement results.

Assessment of ICNIRP Compliance of Individual Emissions

The levels for each measured emission (as adjusted where necessary) are compared to the relevant ICNIRP Public Exposure Limit which applies for the particular frequency of the emission. It should be again noted that the ICNIRP Public Exposure Limit varies according to frequency - the limits for the different measurements presented in the tables will vary as the measurements have been performed at different frequencies.

Assessment of ICNIRP Compliance of Cumulative Emissions

The levels measured for individual emissions are used to calculate **Total Exposure Quotients** to assess the cumulative effect of individual emissions from multiple transmitters. Further details of these quotients are in the explanatory notes which follow the table of measurement results.

The calculated values of the Total Exposure Quotients must be ≤ 1 in order for the aggregate of multiple measurements to satisfy the criteria of the ICNIRP Public Exposure Limit.

Table of Frequency Selective Measurement Results					
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Adjusted Level (V/m)**	**ICNIRP Exposure Limit (V/m)**	**Times below Limit** [adjusted Values]
FM Radio	101.790	0.03427	0.03427	27.7	808.287
FM Radio	99.590	0.02900	0.02900	27.7	955.172
FM Radio	89.990	0.02832	0.02832	27.7	978.107
FM Radio	94.380	0.02784	0.02784	27.7	994.971
FM Radio	96.190	0.02709	0.02709	27.7	1022.518
FM Radio	92.180	0.02666	0.02666	27.7	1039.010
FM Radio	107.390	0.01629	0.01629	27.7	1700.430
FM Radio	103.890	0.01364	0.01364	27.7	2030.792
FM Radio	103.300	0.01091	0.01091	27.7	2538.955
FM Radio	95.390	0.00840	0.00840	27.7	3298.404
FM Radio	96.960	0.00732	0.00732	27.7	3786.222
FM Radio	104.520	0.00644	0.00644	27.7	4298.572
FM Radio	88.370	0.00474	0.00474	27.7	5838.954
TETRA	390.410	0.20900	0.36200	27.7	76.520
TETRA	393.860	0.00342	0.00592	27.7	4681.675
TETRA	390.860	0.00214	0.00371	27.7	7473.179
TETRA	392.940	0.00187	0.00325	27.7	8533.939
DVB-T	473.630	0.01326	0.01565	29.9	1912.479
DVB-T	496.970	0.00976	0.01152	30.7	2661.013
LTE	763.000	0.05360	0.15330	38.0	247.762
LTE	773.000	0.04200	0.12012	38.2	318.256
LTE	783.000	0.09070	0.25940	38.5	148.324
LTE	796.000	0.05930	0.16960	38.8	228.738
LTE	806.000	0.03750	0.10725	39.0	363.976
LTE	816.000	0.05280	0.15101	39.3	260.104
GSM	947.001	0.33310	0.66620	42.3	63.515
GSM	956.406	0.22630	0.45260	42.5	93.953
GSM	929.406	0.22350	0.44700	41.9	93.777
UMTS FDD	953.500	0.50440	1.88359	42.5	22.541
UMTS FDD	932.500	0.14530	0.54260	42.0	77.384
UMTS FDD	937.000	0.14360	0.53625	42.1	78.489
UMTS FDD	943.000	0.13090	0.48882	42.2	86.379
LTE	1815.000	0.16610	0.58189	58.6	100.670
LTE	1830.000	0.15470	0.62579	58.8	93.994
LTE	1855.000	0.15270	0.61770	59.2	95.873
LTE	1875.000	0.20710	0.72552	59.5	82.064
LTE	2120.000	0.07020	0.29905	61.0	203.978
LTE	2140.000	0.22150	0.94359	61.0	64.647
LTE	2160.000	0.22810	0.97171	61.0	62.776
5GNR	3569.714	0.01718	0.06341	61.0	962.009
5GNR	3582.714	0.02053	0.19688	61.0	309.829
5GNR	3597.571	0.11443	1.09737	61.0	55.587

5GNR	3612.429	0.01521	0.14582	61.0	418.328
5GNR	3749.238	0.01283	0.12229	61.0	498.834

Total Exposure Quotients [calculated from Adjusted Levels]			
Quotient	**Frequency Range**	**Calculated Quotient Value**	**Limit**
Electrical Stimulation Effects (as per ICNIRP 2010)	**1 Hz to 10 MHz**	n/a	1
Thermal Effects etc. (as per ICNIRP 2020)	**100 kHz and above**	0.004529	1

Overall Conclusions of the Survey	
Frequency Selective Measurements: (Individual emissions measured at specific frequencies)	**Below ICNIRP Public Exposure Limits (Compliant)**
Total Exposure Quotient: (Assessment of cumulative emissions from multiple transmitters)	**Below ICNIRP Public Exposure Limits (Compliant)**

Explanatory Notes

Adjusted Levels

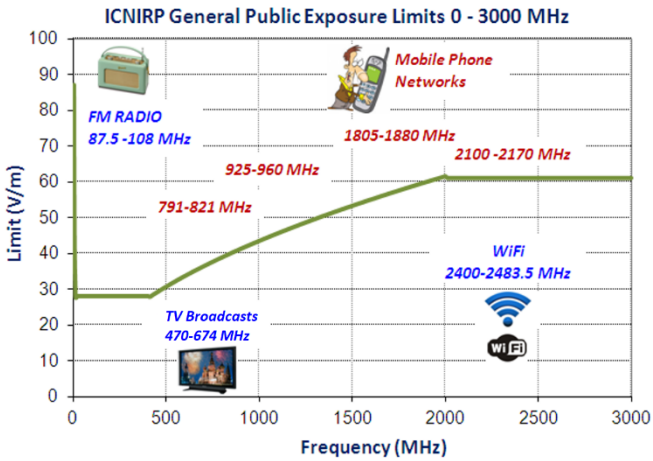
For some emissions, an adjusted level may be required to be derived from the measured level:

(1) to compensate for the limited measurement resolution of the spectrum analyser. For example, a measurement of a DVB-T (digital TV) signal performed with a resolution of 5 MHz needs to be adjusted upwards using a correction factor to account for the energy present within the full 7.61 MHz bandwidth of the signal; and/or

(2) to extrapolate to an estimate of the level under maximum traffic or duty cycle from the transmitter. For example, the base stations of mobile phone networks produce emissions which vary according to the changing volume of calls or data traffic over the course of the day.

ICNIRP Public Exposure Limits

These are set out in the ICNIRP Guidelines as reference levels for the practical assessment of exposure to electric and magnetic fields, as experienced by the general public (excluding occupational exposure and exposure during medical procedures). The limits vary according to the frequency of the emissions as illustrated in the adjacent diagram. For example, the limits for Wi-Fi in the 2400-2483.5 MHz frequency band are higher than those for FM Radio transmissions in the much lower 87.5-108 MHz frequency band.



Total Exposure Quotients

The Total Exposure Quotients (which must be ≤ 1) are calculated in accordance with mathematical formulas specified in the ICNIRP Guidelines to assess the cumulative effect of emissions from multiple transmitters. The quotients in this report are calculated from the Adjusted Levels rather than from the Measured Levels to account for total potential public exposure under maximum traffic conditions.

The two quotients are as follows:

(1) Quotient for Electrical Stimulation Effects (1 Hz to 10 MHz)
This quotient is calculated only in a small number of cases where strong emissions in the frequency range between 1 Hz and 10 MHz are present at the survey location (e.g. near a long wave radio transmitter site). This essentially involves summing the ratios (measured field strength/applicable limit) for each emission.

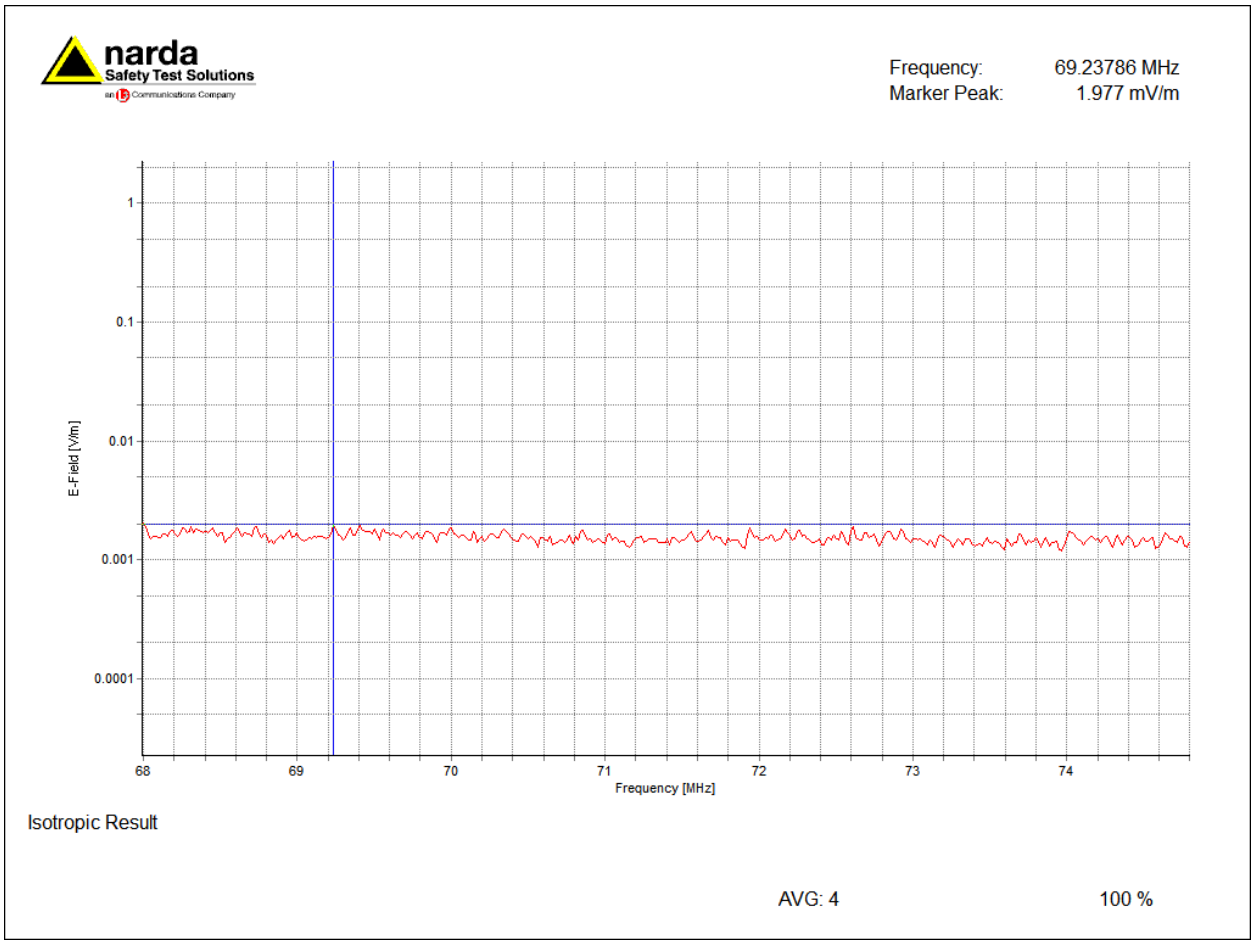
(2) Quotient for Thermal Effects etc. (100 kHz and above)
The measurements of any emissions above 100 kHz are used to calculate a quotient to assess any thermal (heat) and other effects as per ICNIRP 2020. This essentially involves summing the squares of the ratios (measured field strength/applicable limit) for each emission.

9. Frequency Selective Measurements - Detailed Results

Detailed results of the frequency selective measurements, including spectrum analyser scan graphs, are presented on the following pages. The results show the NIR levels by frequency in V/m and include the number of times they are below the ICNIRP Public Exposure Limits (which are frequency dependent).

In the cases of GSM and TETRA, the 'pilot' (or BCCH and MCCH respectively) frequency of each base station is shown. Alternatively for LTE and LTE+ the highest centre frequency is typically identified in place of the 'pilot' frequency. An adjusted level, if applicable, is also shown. Further details regarding the calculation of adjusted levels are contained in document 08/51R4.

Spectrum Analyser Results	PMR VHF Low Band	68 – 74.8 MHz



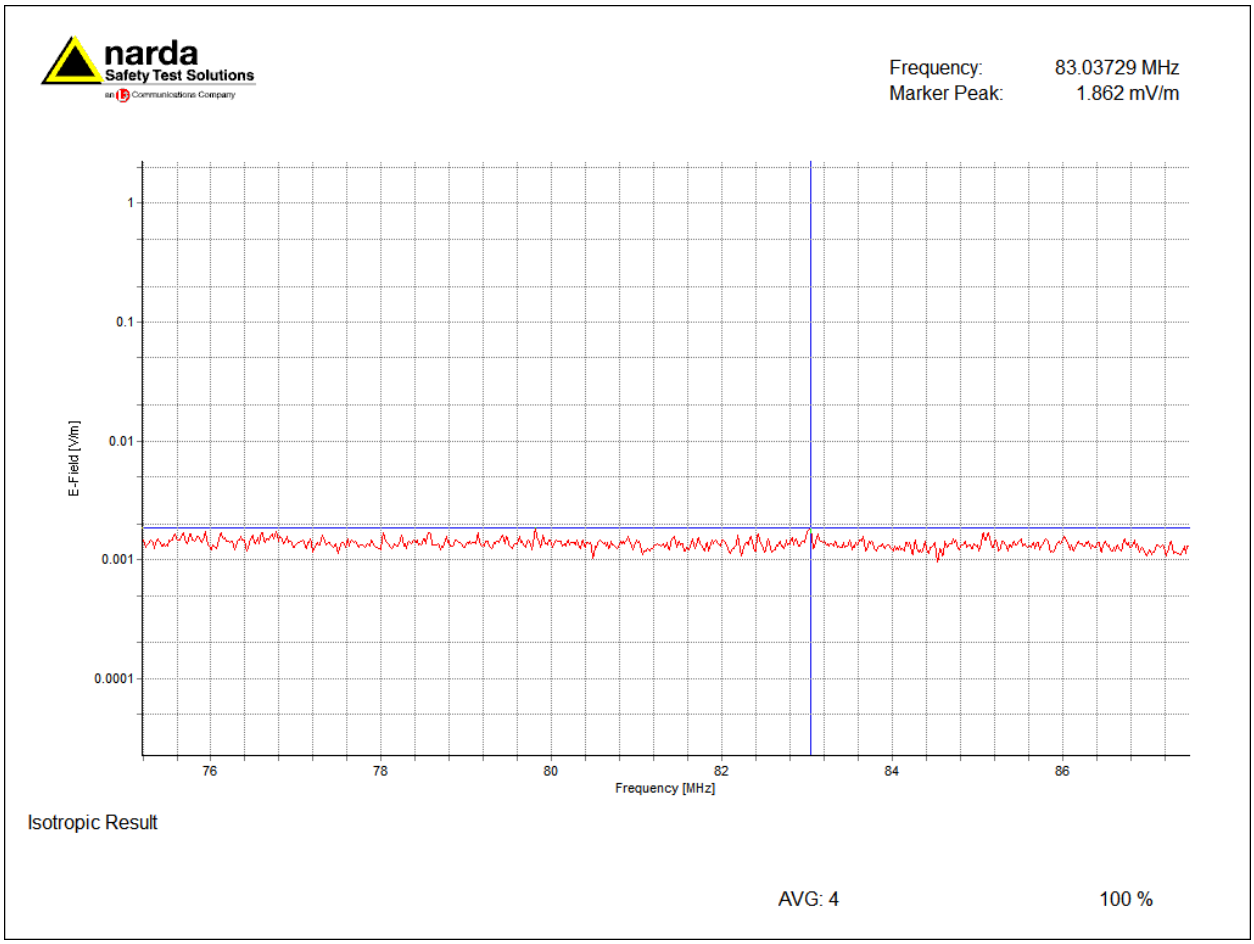
No measurable signal detected

Trace Mode	Max Hold	**RBW**	30 kHz	**Detector**	AVERAGE (RMS)

Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	PMR VHF Low Band	75.2 - 87.5 MHz



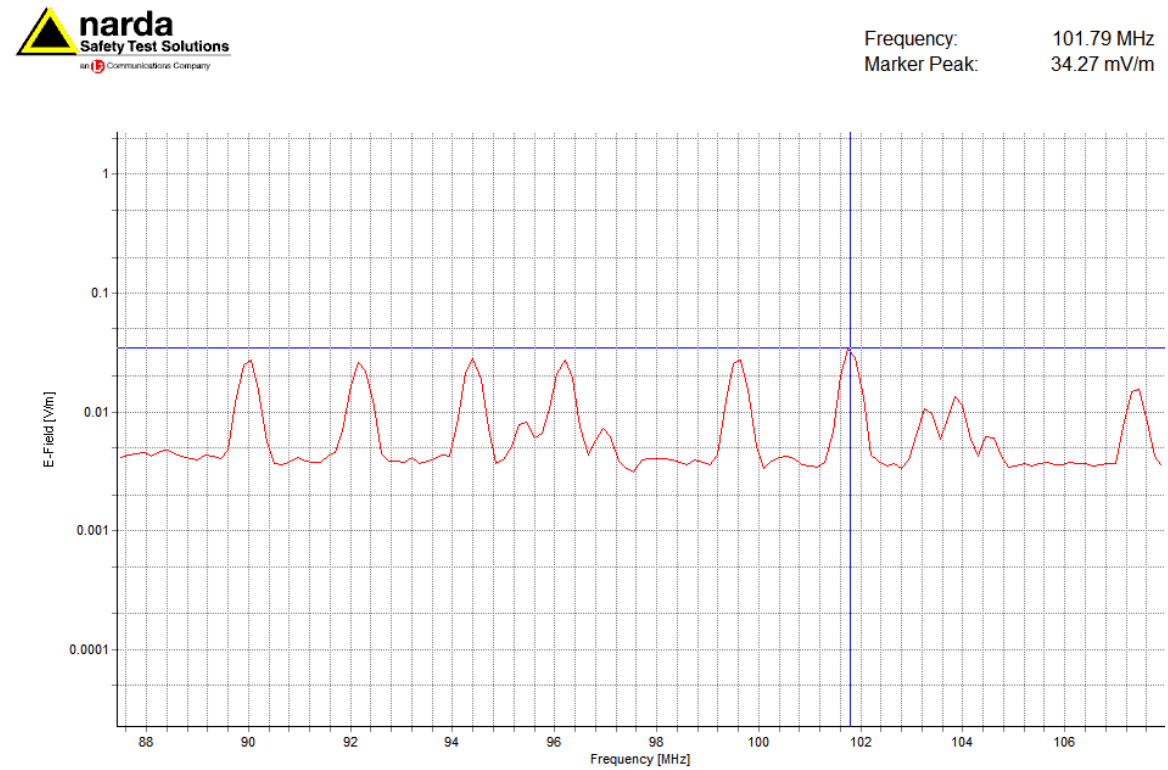
No measurable signal detected

Trace Mode	Max Hold	RBW	30 kHz	Detector	AVERAGE (RMS)

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	FM Radio Band	87.5 - 108 MHz



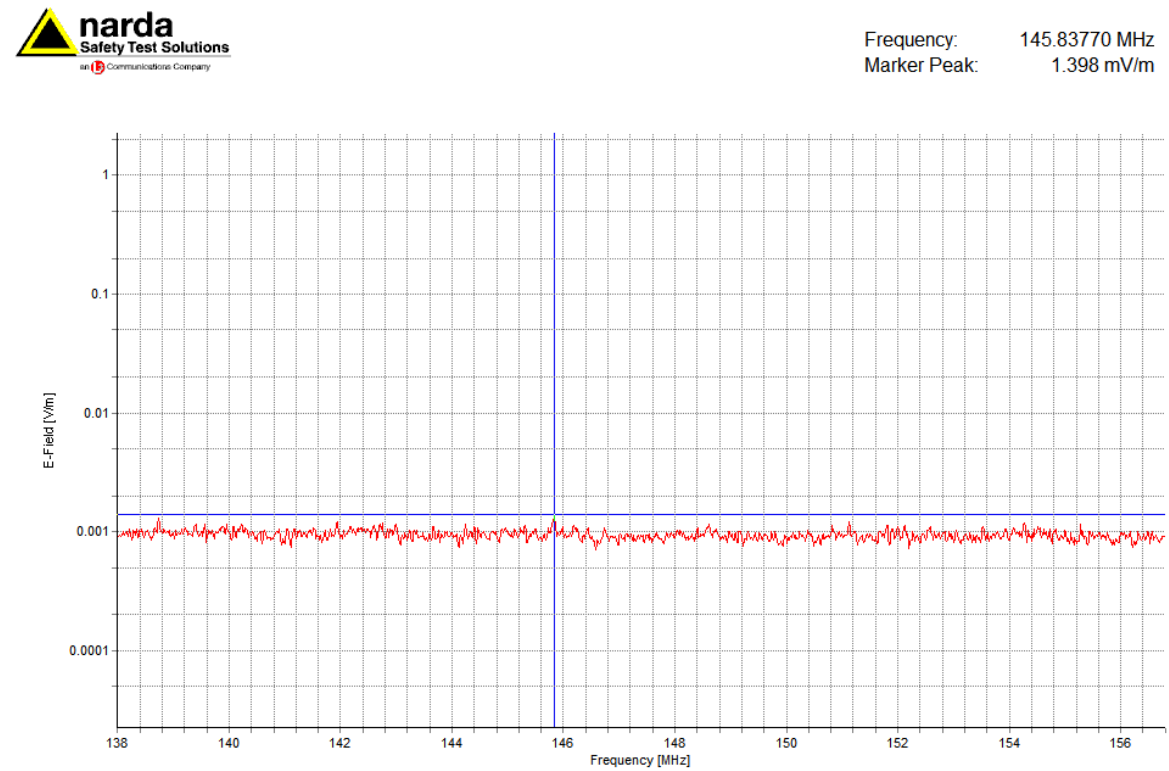
Trace Mode	Max Hold	RBW	300 kHz	Detector	AVERAGE (RMS)

Emission Type	Frequency (MHz)	Measured Level (V/m)	ICNIRP LIMIT (V/m)	Times Below Limit
FM Radio	101.790	0.034270	27.7	808.287
FM Radio	99.590	0.029000	27.7	955.172
FM Radio	89.990	0.028320	27.7	978.107
FM Radio	94.380	0.027840	27.7	994.971
FM Radio	96.190	0.027090	27.7	1022.518
FM Radio	92.180	0.026660	27.7	1039.010
FM Radio	107.390	0.016290	27.7	1700.430
FM Radio	103.890	0.013640	27.7	2030.792
FM Radio	103.300	0.010910	27.7	2538.955
FM Radio	95.390	0.008398	27.7	3298.404
FM Radio	96.960	0.007316	27.7	3786.222
FM Radio	104.520	0.006444	27.7	4298.572
FM Radio	88.370	0.004744	27.7	5838.954

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	PMR VHF Mid Band	138 – 156.8 MHz



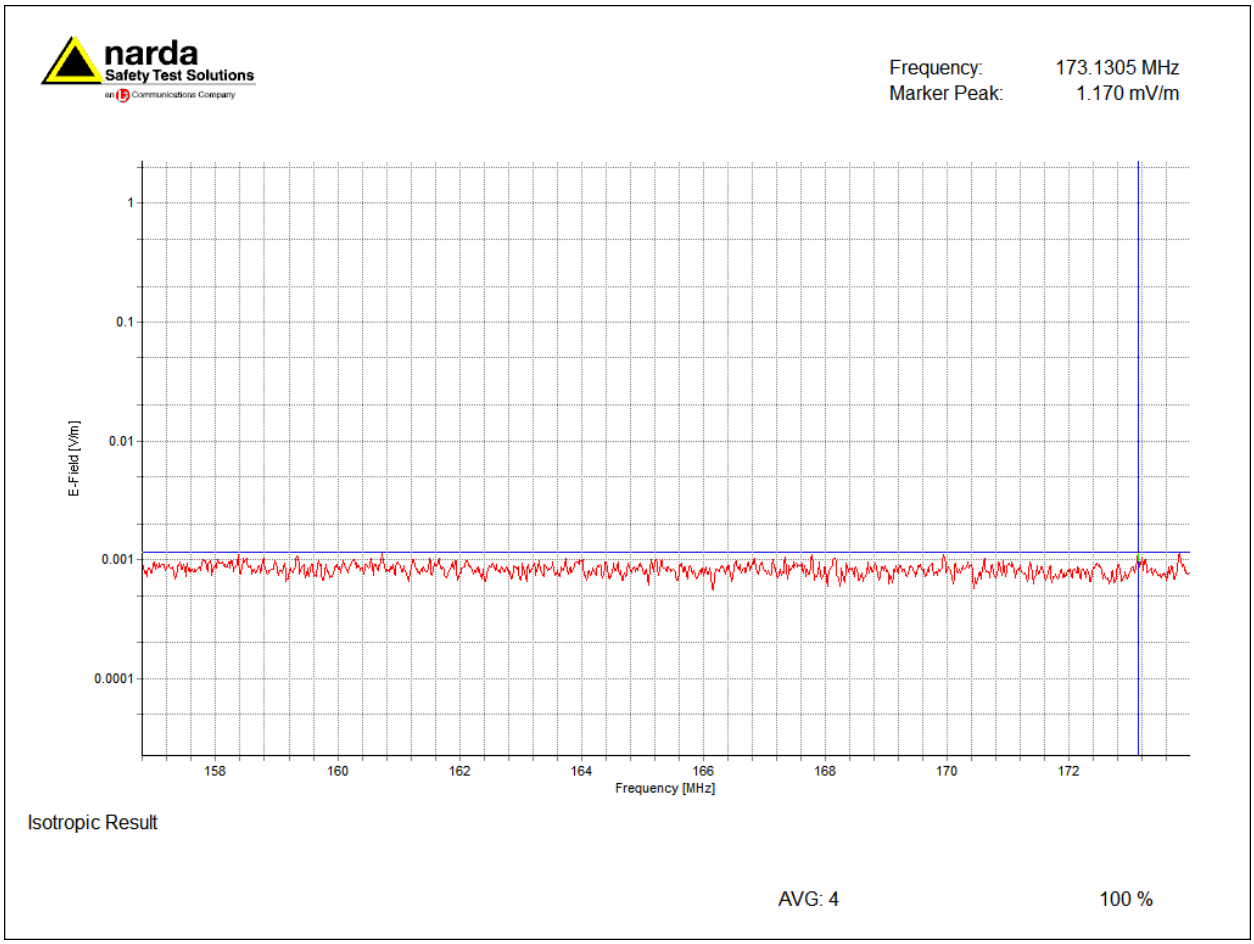
No measurable signal detected

Trace Mode	Max Hold	RBW	30 kHz	Detector	AVERAGE (RMS)

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	PMR VHF High Band	156.8 - 174 MHz



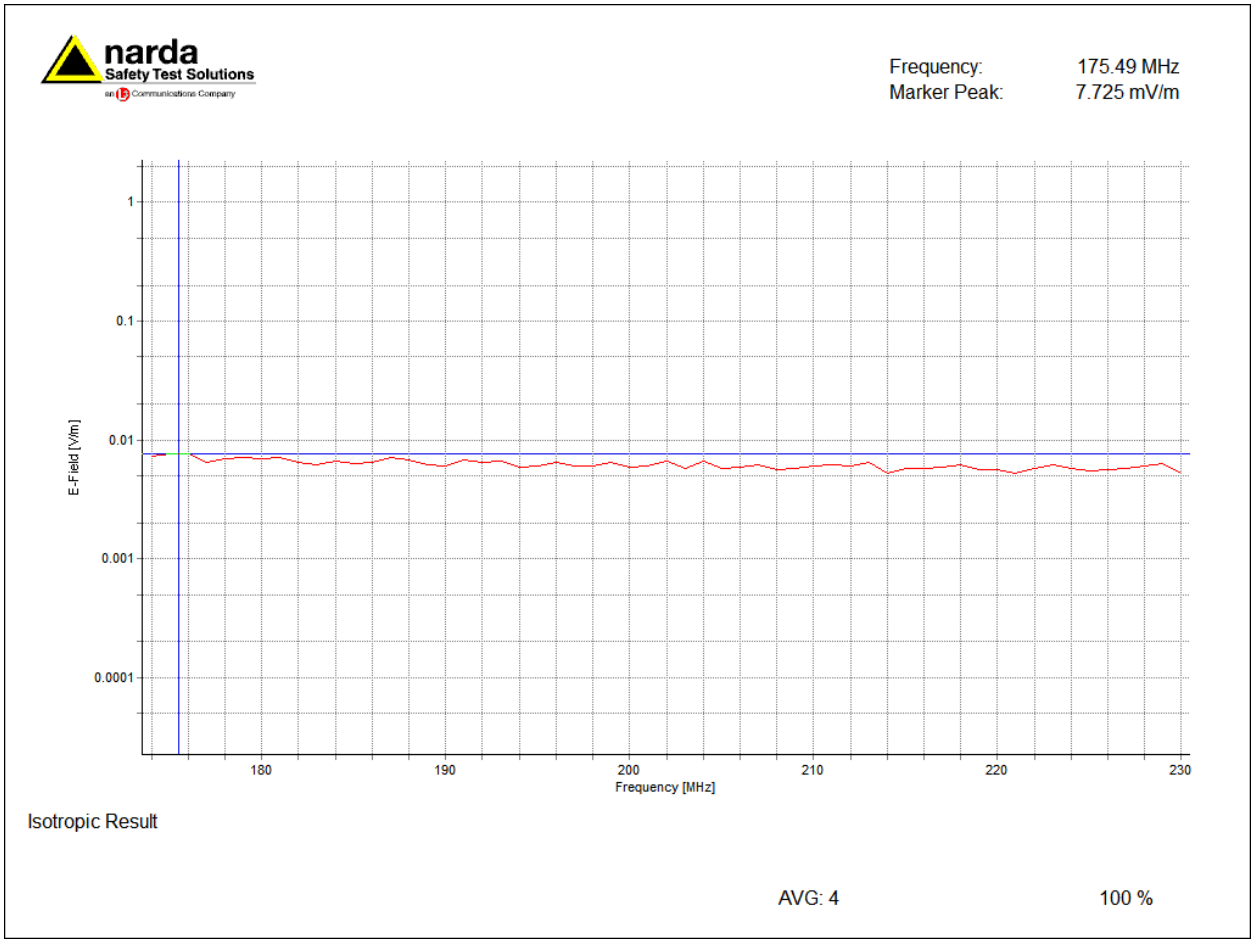
No measurable signal detected

Trace Mode	Max Hold	**RBW**	30 kHz	**Detector**	AVERAGE (RMS)

Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	T-DAB Band	174 - 230 MHz



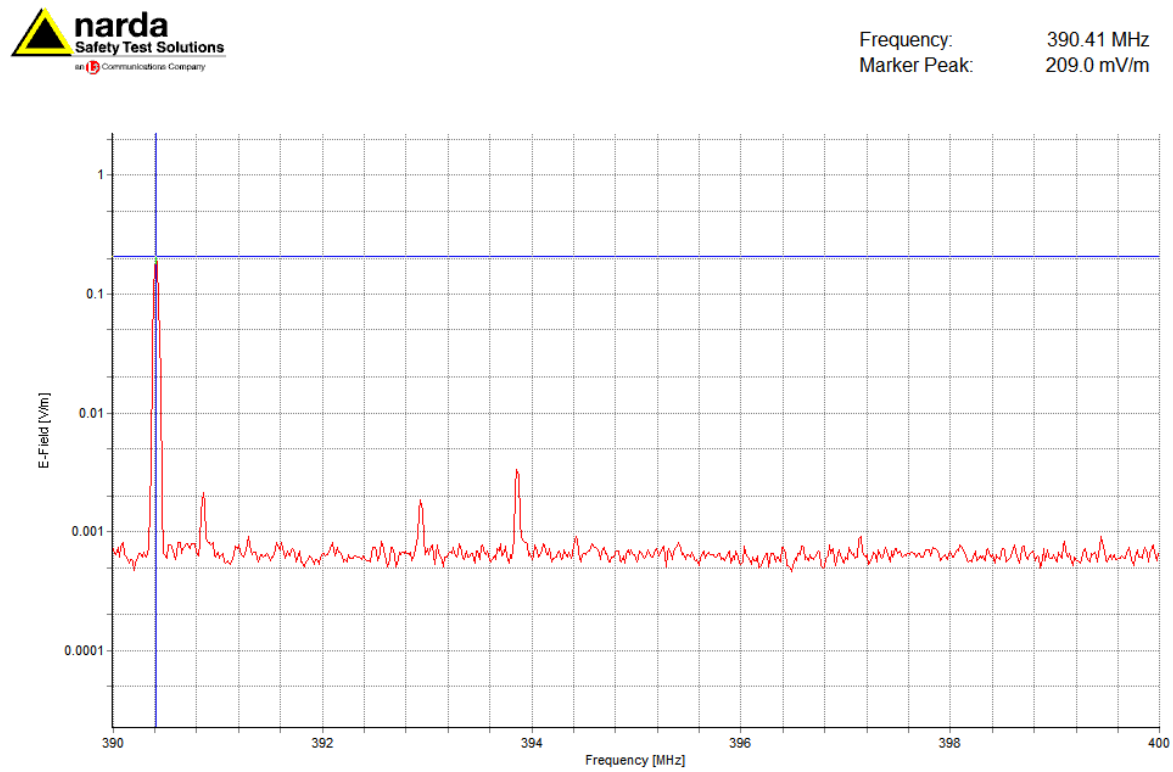
No measurable signal detected

Trace Mode	Max Hold	**RBW**	2 MHz	**Detector**	AVERAGE (RMS)

Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results TETRA Band 390 - 400 MHz



Isotropic Result

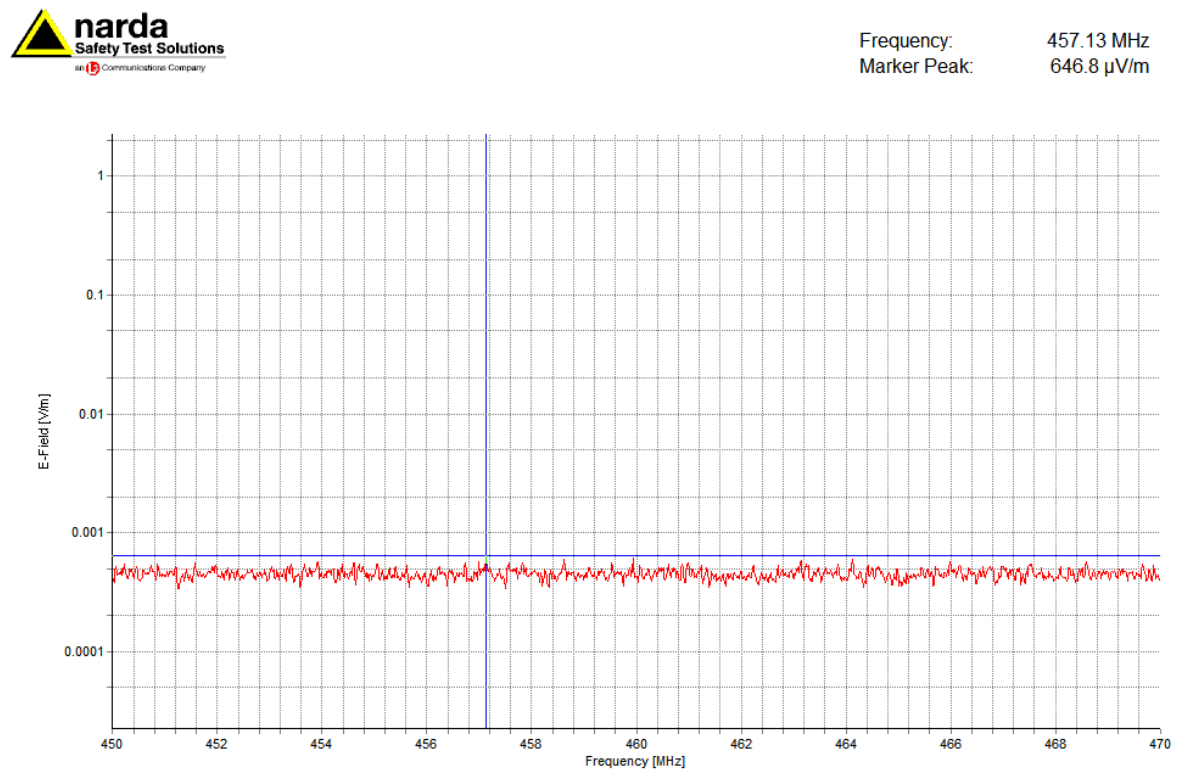
Trace Mode	Max Hold	RBW	30 kHz	Detector	MAX (Peak Value)

				Adjusted E-Field		
Emission Type	MCCH Carrier (MHz)	Measured Level (V/m)	No. of Carriers (MCCH + TCHs)	Est. Max Traffic Level (V/m)	ICNIRP LIMIT (V/m)	Times Below Limit
TETRA	390.410	0.209000	3	0.361999	27.7	76.520
TETRA	393.860	0.003416	3	0.005917	27.7	4681.675
TETRA	390.860	0.002140	3	0.003707	27.7	7473.179
TETRA	392.940	0.001874	3	0.003246	27.7	8533.939

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	PMR UHF High Band	450 - 470 MHz



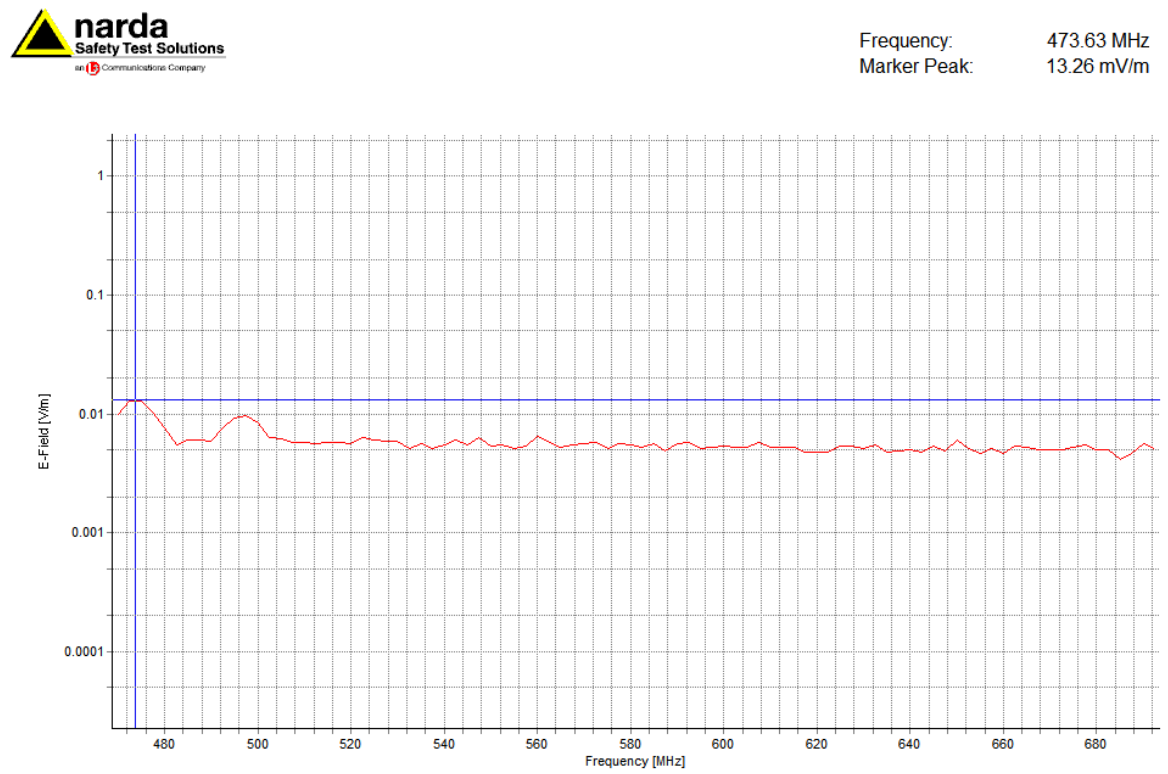
No measurable signal detected

Trace Mode	Max Hold	RBW	30 kHz	Detector	AVERAGE (RMS)

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results UHF TV 470 - 694 MHz



Trace Mode	Max Hold	RBW	5 MHz	Detector	AVERAGE (RMS)

			Adjusted E-Field			
Emission Type	Frequency (MHz)	Measured Level (V/m)	RBW Correction Factor	Adjusted Level (V/m)	ICNIRP LIMIT (V/m)	Times Below Limit
DVB-T	473.630	0.013260	1.18	0.015647	29.9	1912.479
DVB-T	496.970	0.009762	1.18	0.011519	30.7	2661.013

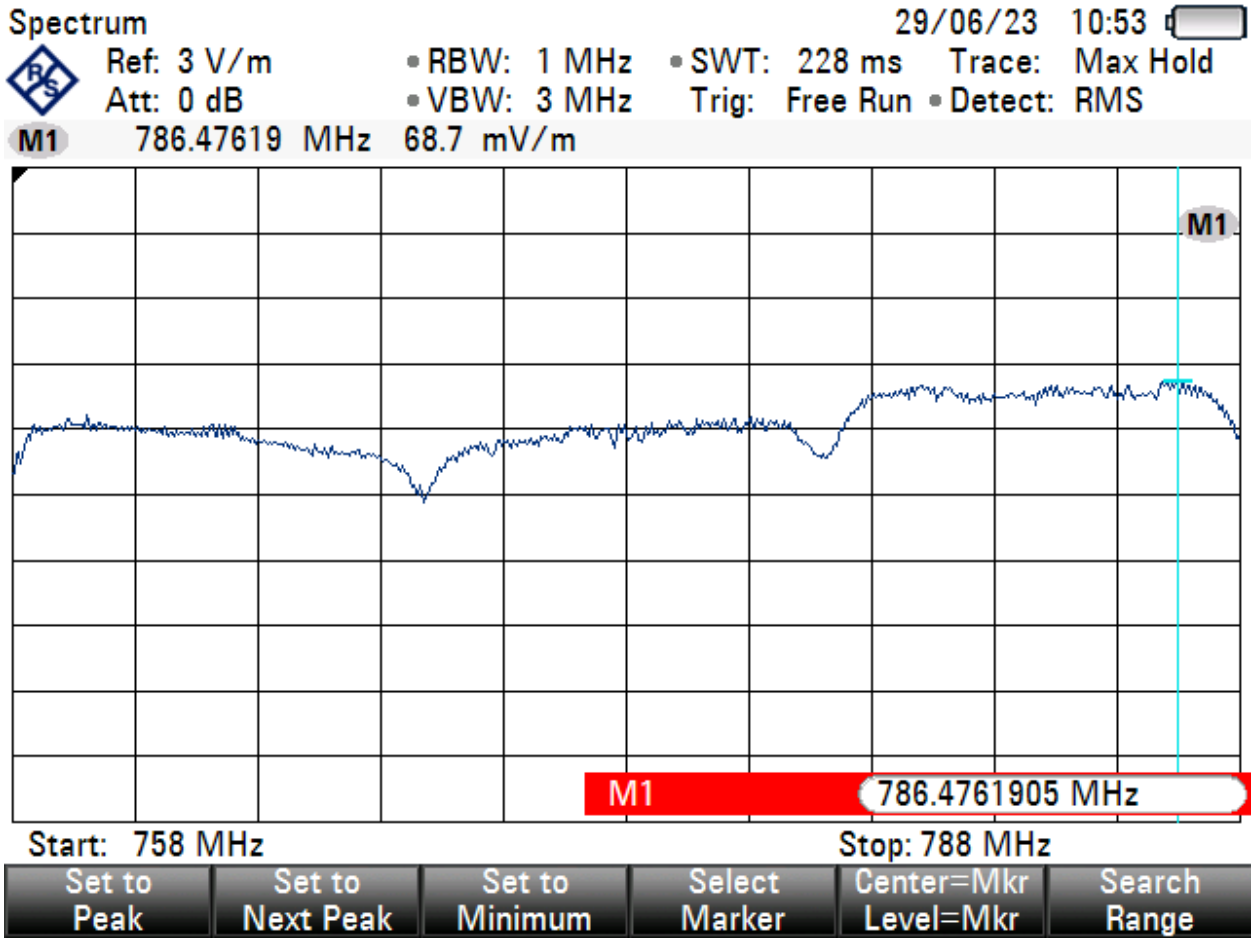
Receiver		Antenna	
Manufacturer	Narda	Manufacturer	Narda
Model	SRM 3000	Model	SRM 3-Axis Antenna
Serial Number	M-0082	Serial Number	H-0254
Calibration Date	22/02/2023	Calibration Date	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	+2.4 / -3.3 dB

Spectrum Analyser Results	700 MHz	758 - 788 MHz

LTE Measurements **758 – 788 MHz**

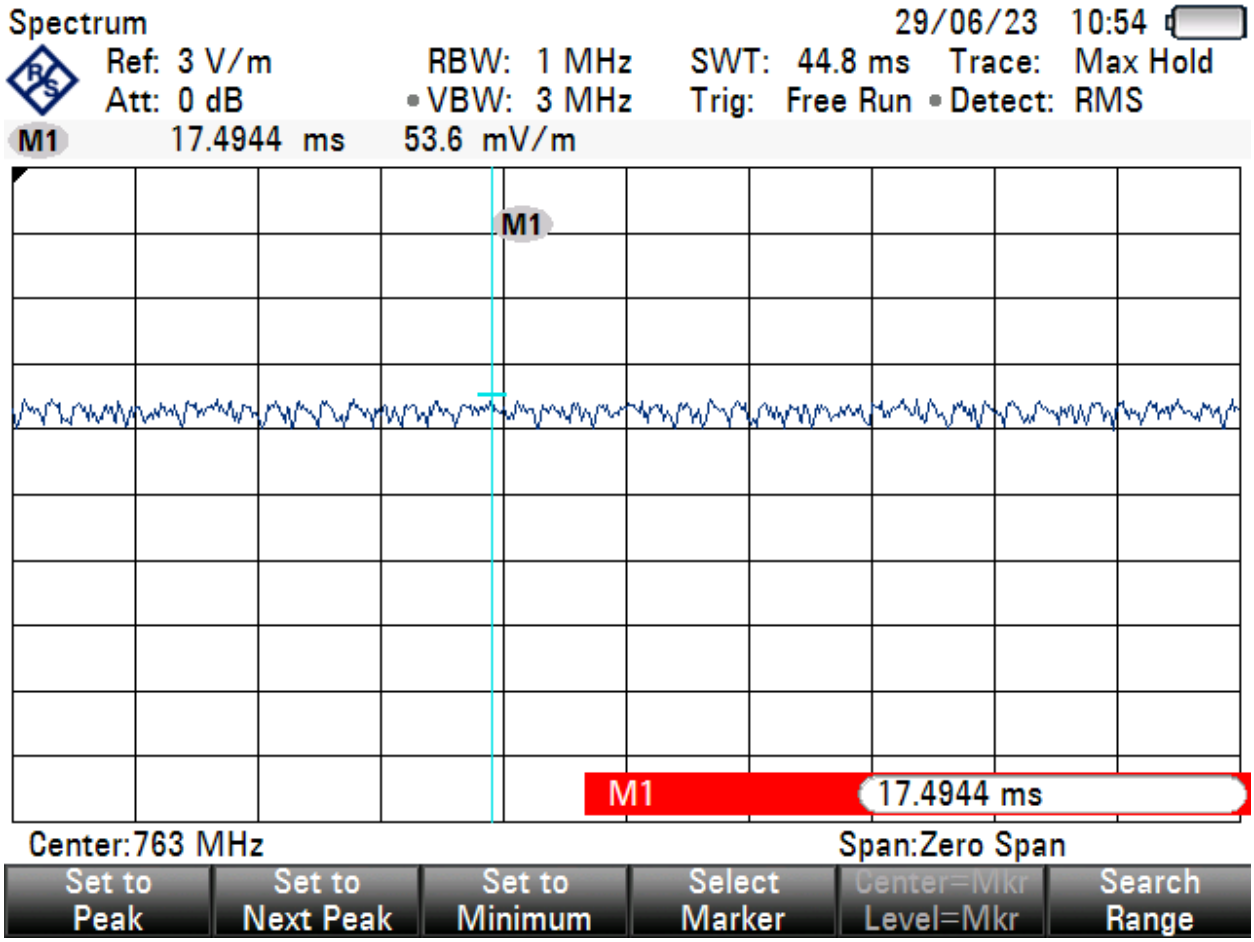
LTE Downlink Signals Detected in Band:



Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 763 MHz:

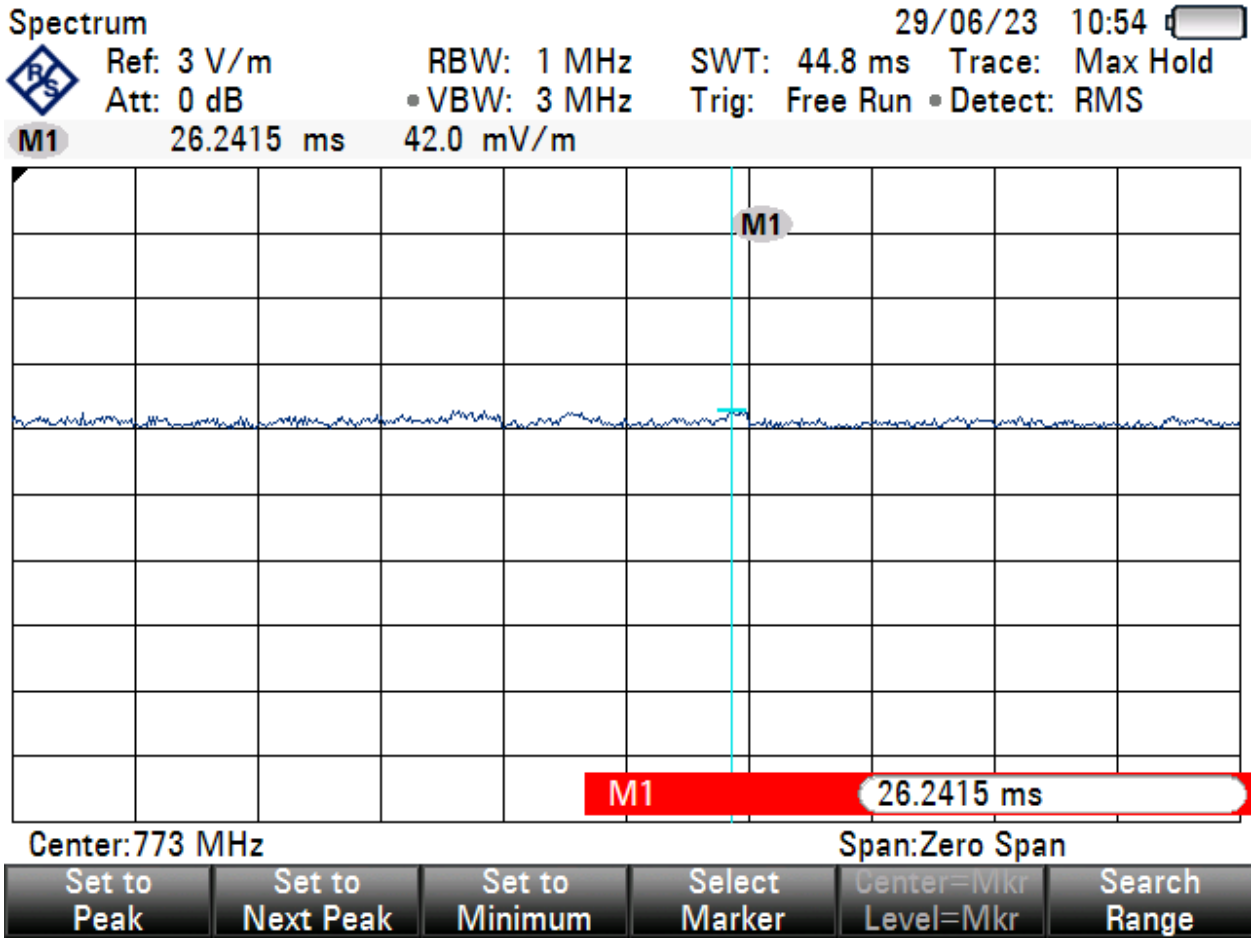


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	763.000	0.053600	2.86	0.153296	38.0	247.762

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 773 MHz:

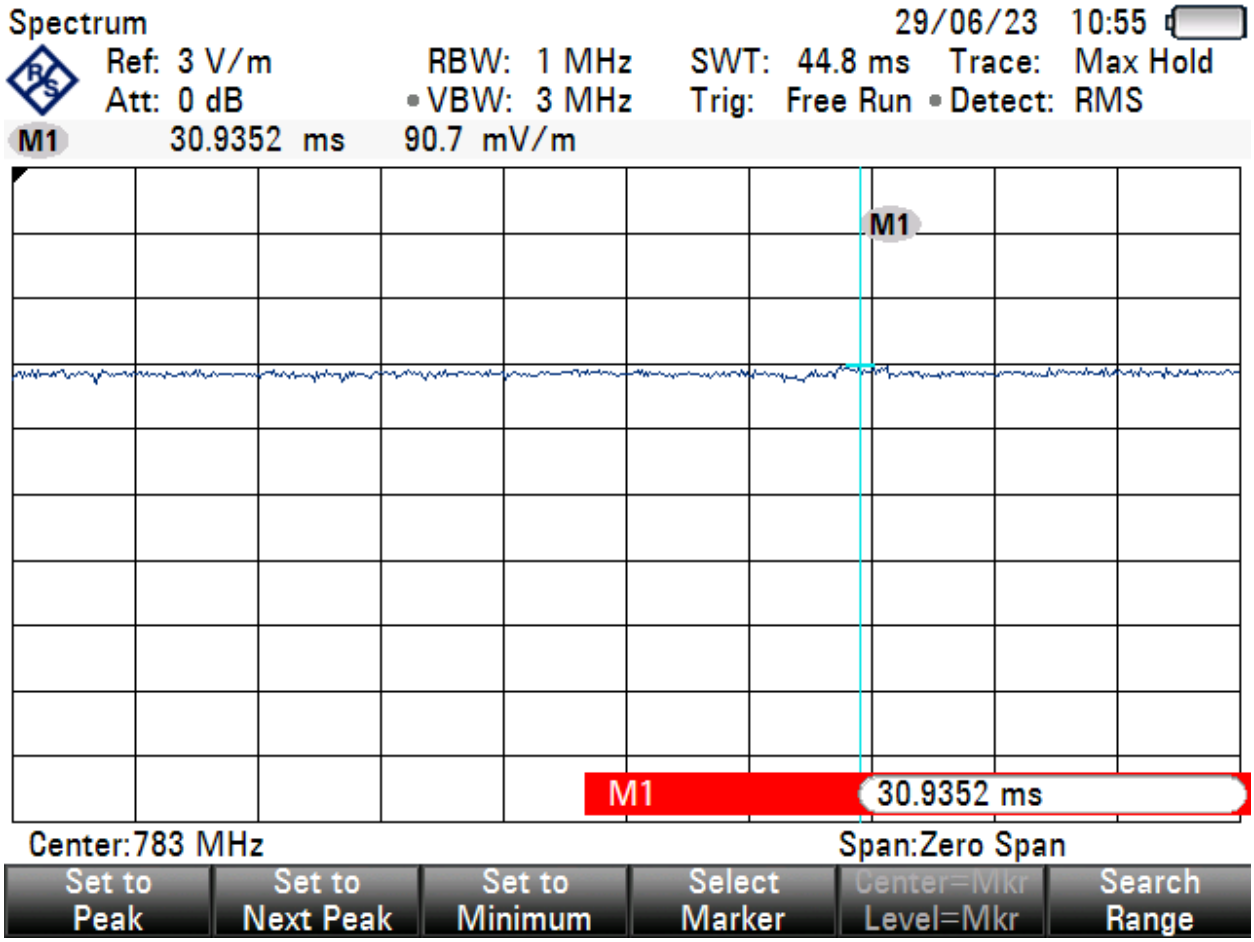


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	773.000	0.042000	2.86	0.120120	38.2	318.256

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 783 MHz:



			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	783.000	0.090700	2.86	0.259402	38.5	148.324

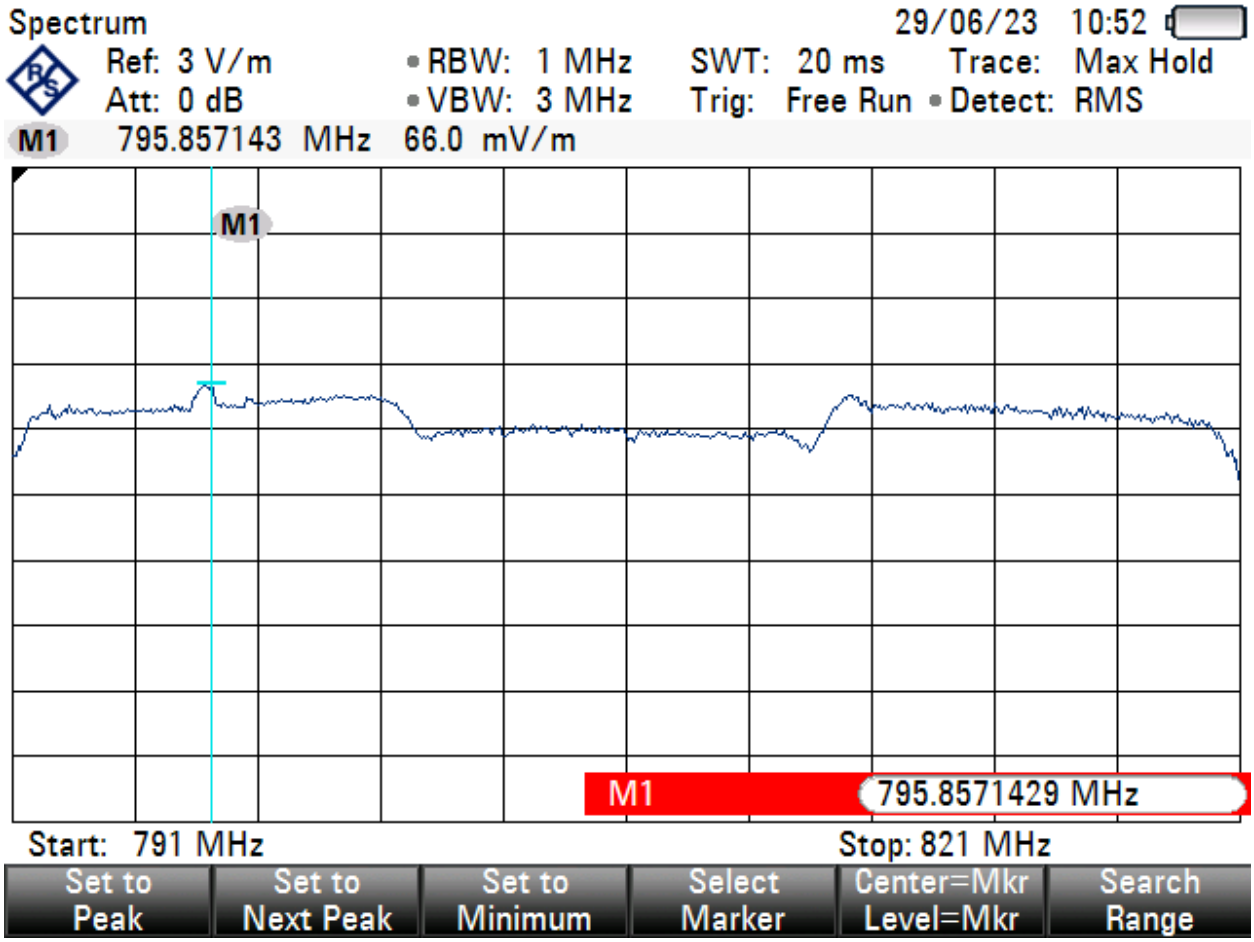
Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results	800 MHz Band	791 – 821 MHz

LTE Measurements **791 – 821 MHz**

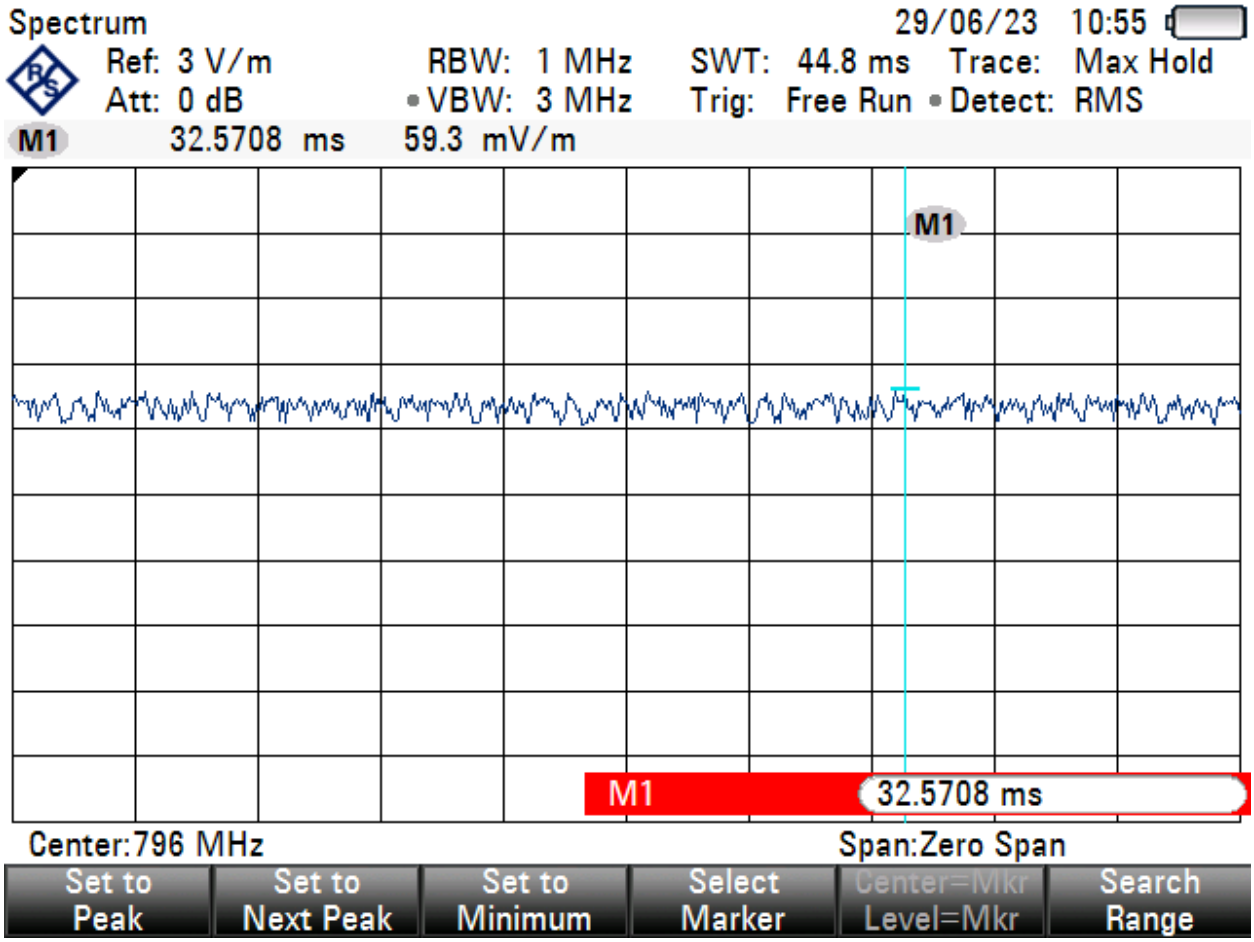
LTE Downlink Signals Detected in Band:



Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 796 MHz:

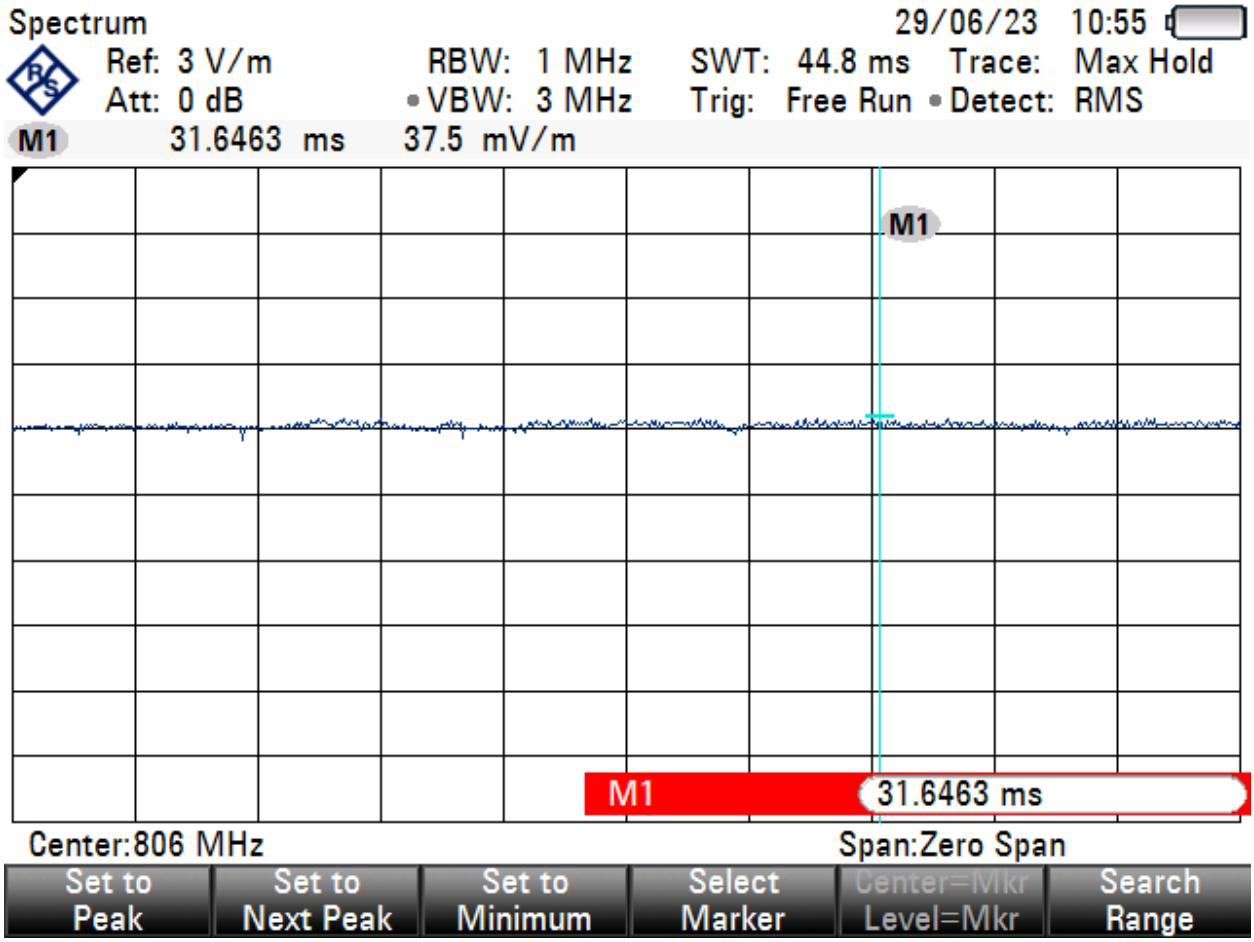


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	796.000	0.059300	2.86	0.169598	38.8	228.738

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 806 MHz:

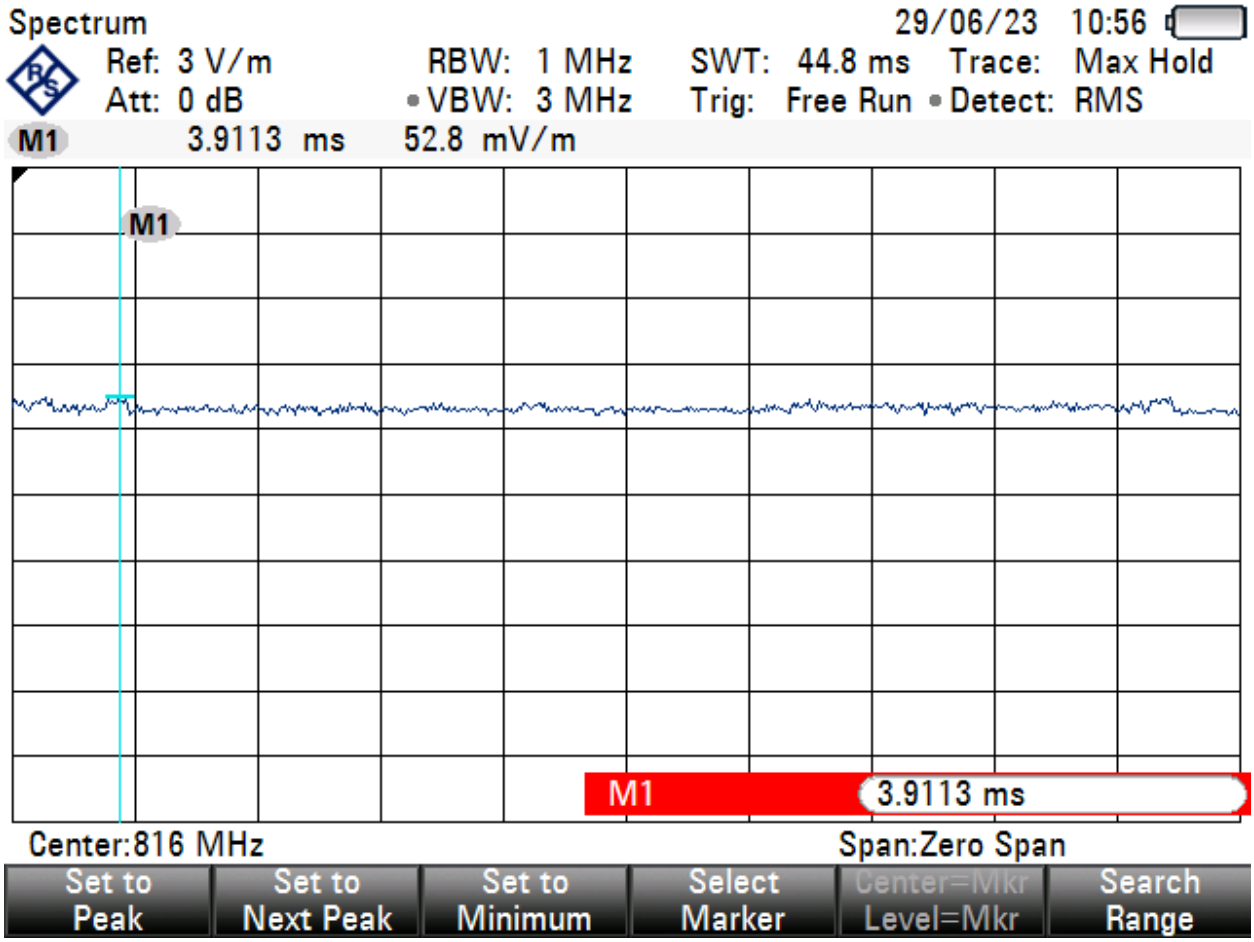


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	806.000	0.037500	2.86	0.107250	39.0	363.976

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 816 MHz:



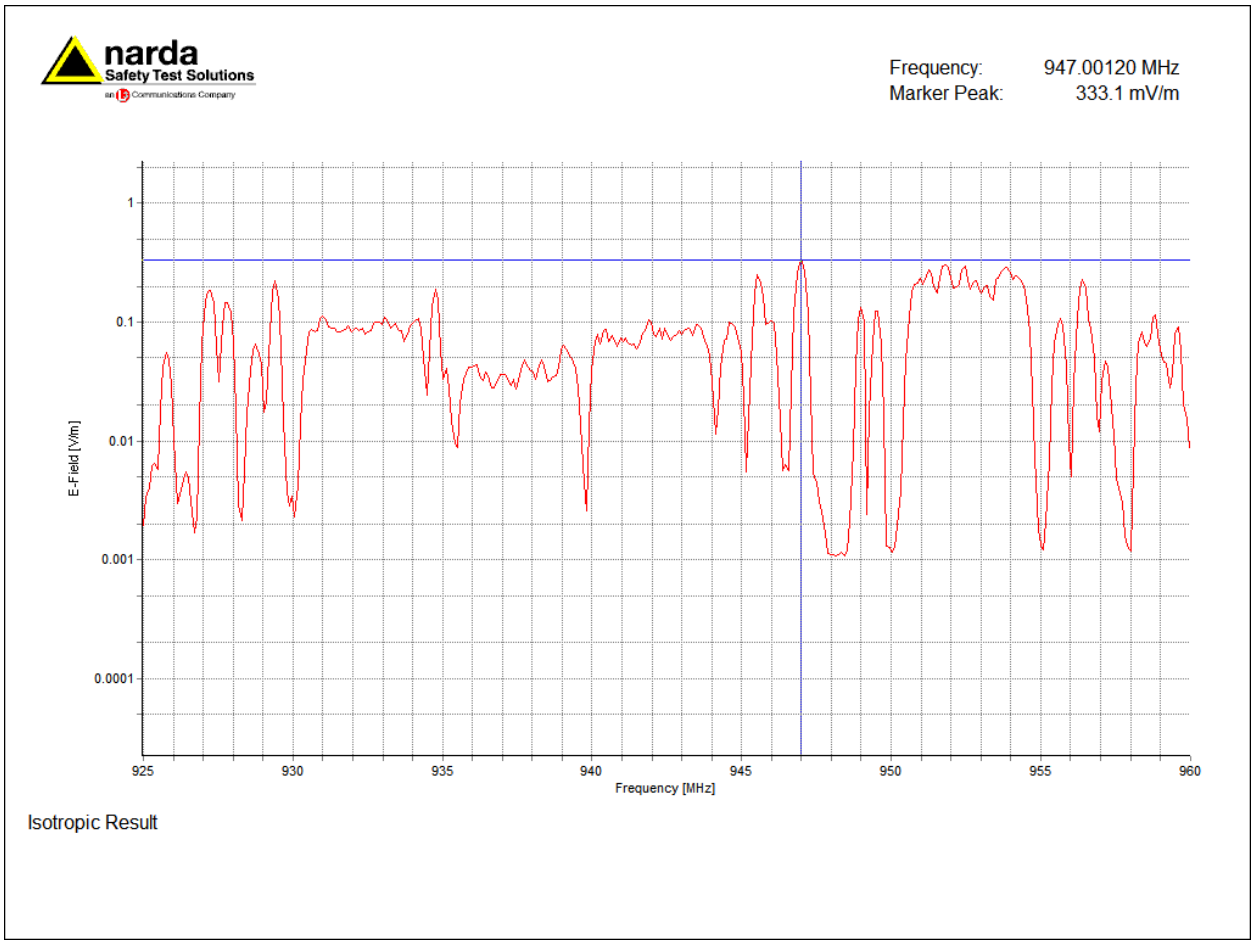
			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	816.000	0.052800	2.86	0.151008	39.3	260.104

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results 900 MHz Band 925 - 960 MHz

GSM Measurements 925 – 960 MHz



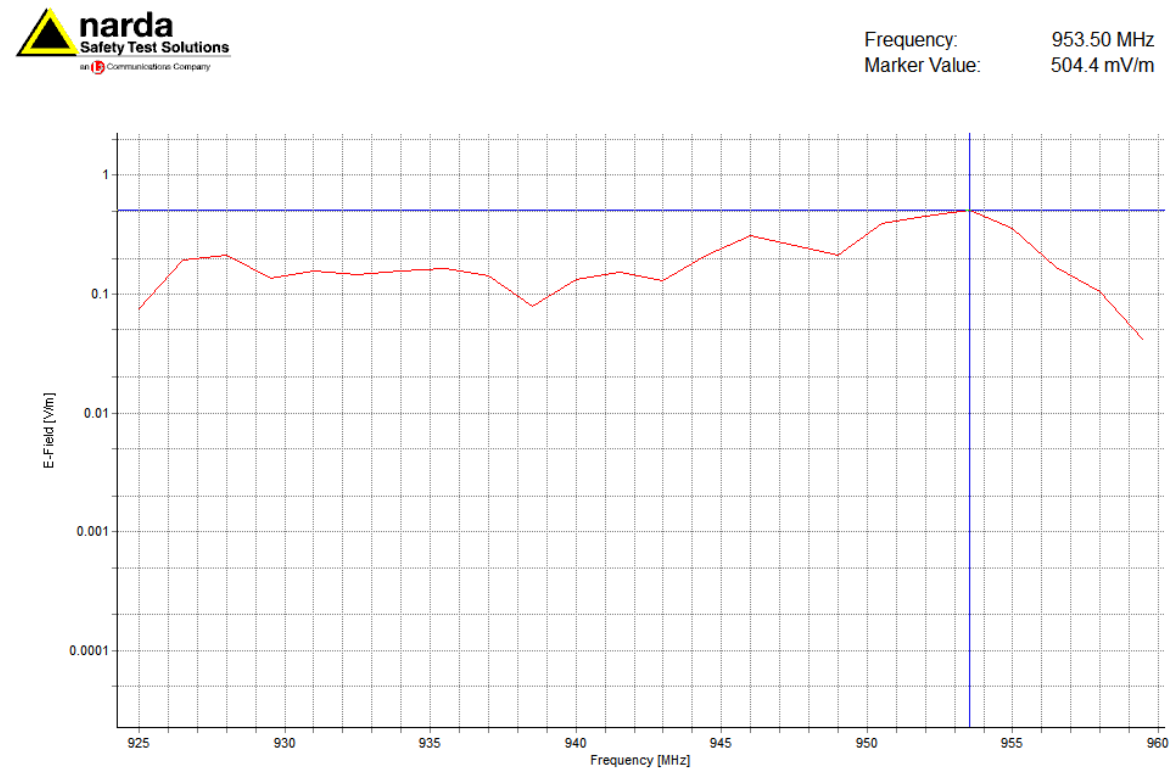
Trace Mode	Max Hold	**RBW**	200 kHz	**Detector**	MAX (Peak Value)

			Adjusted E-Field			
Emission Type	**BCCH Carrier (MHz)**	**Measured Level (V/m)**	**No. of Carriers (BCCH + TCHs)**	**Est. Max Traffic Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
GSM	947.001	0.333100	4	0.666200	42.3	63.515
GSM	956.406	0.226300	4	0.452600	42.5	93.953
GSM	929.406	0.223500	4	0.447000	41.9	93.777

Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

UMTS Measurements 925 – 960 MHz



Trace Mode	Actual	RBW	3 MHz	Detector	AVERAGE (RMS)

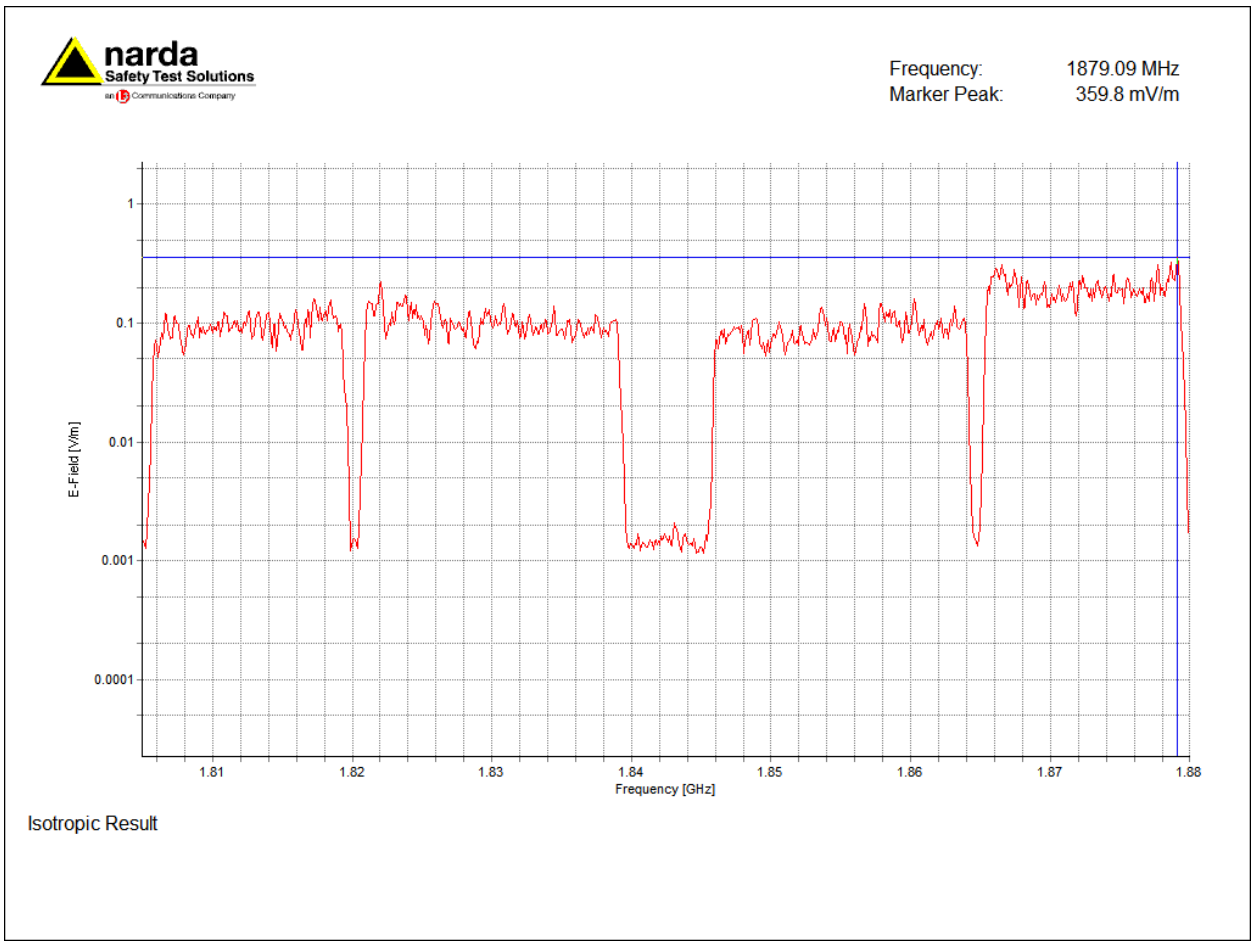
			Adjusted E Field				
Emission Type	Frequency (MHz)	Measured Level (V/m)	RBW Correction Factor	Max Traffic Extrapolation Factor	Est. Max Traffic Level (V/m)	ICNIRP LIMIT (V/m)	Times Below Limit
UMTS FDD	953.500	0.504400	1.181	3.162	1.883592	42.5	22.541
UMTS FDD	932.500	0.145300	1.181	3.162	0.542597	42.0	77.384
UMTS FDD	937.000	0.143600	1.181	3.162	0.536249	42.1	78.489
UMTS FDD	943.000	0.130900	1.181	3.162	0.488823	42.2	86.379

Receiver		Antenna	
Manufacturer	Narda	Manufacturer	Narda
Model	SRM 3000	Model	SRM 3-Axis Antenna
Serial Number	M-0082	Serial Number	H-0254
Calibration Date	22/02/2023	Calibration Date	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	+2.4 / -3.3 dB

Spectrum Analyser Results 1800 MHz Band 1805 – 1880 MHz

GSM Measurements 1805 – 1880 MHz



No measurable signal detected

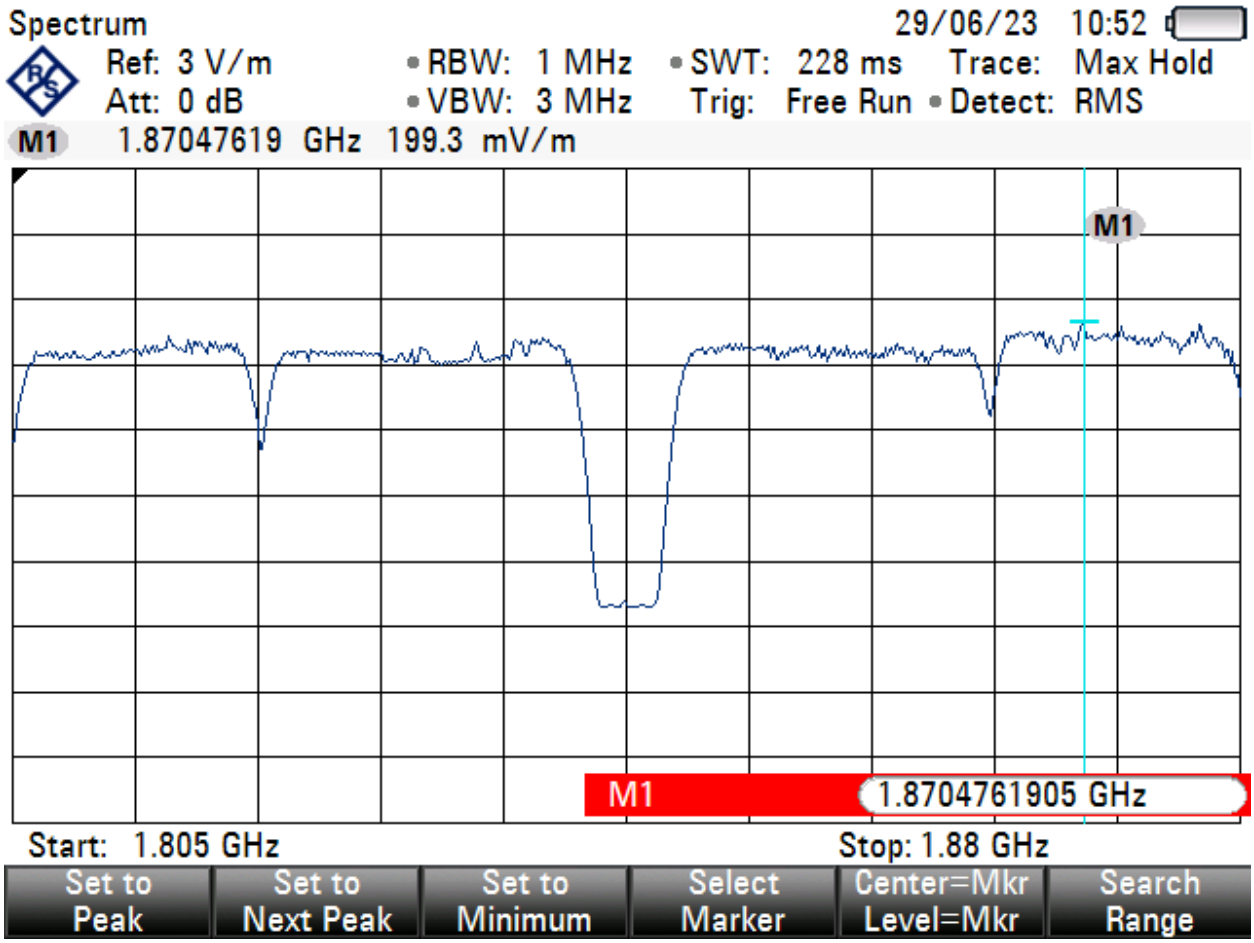
Trace Mode	Max Hold	**RBW**	200 kHz	**Detector**	MAX (Peak Value)

Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

LTE Measurements **1805 – 1880 MHz**

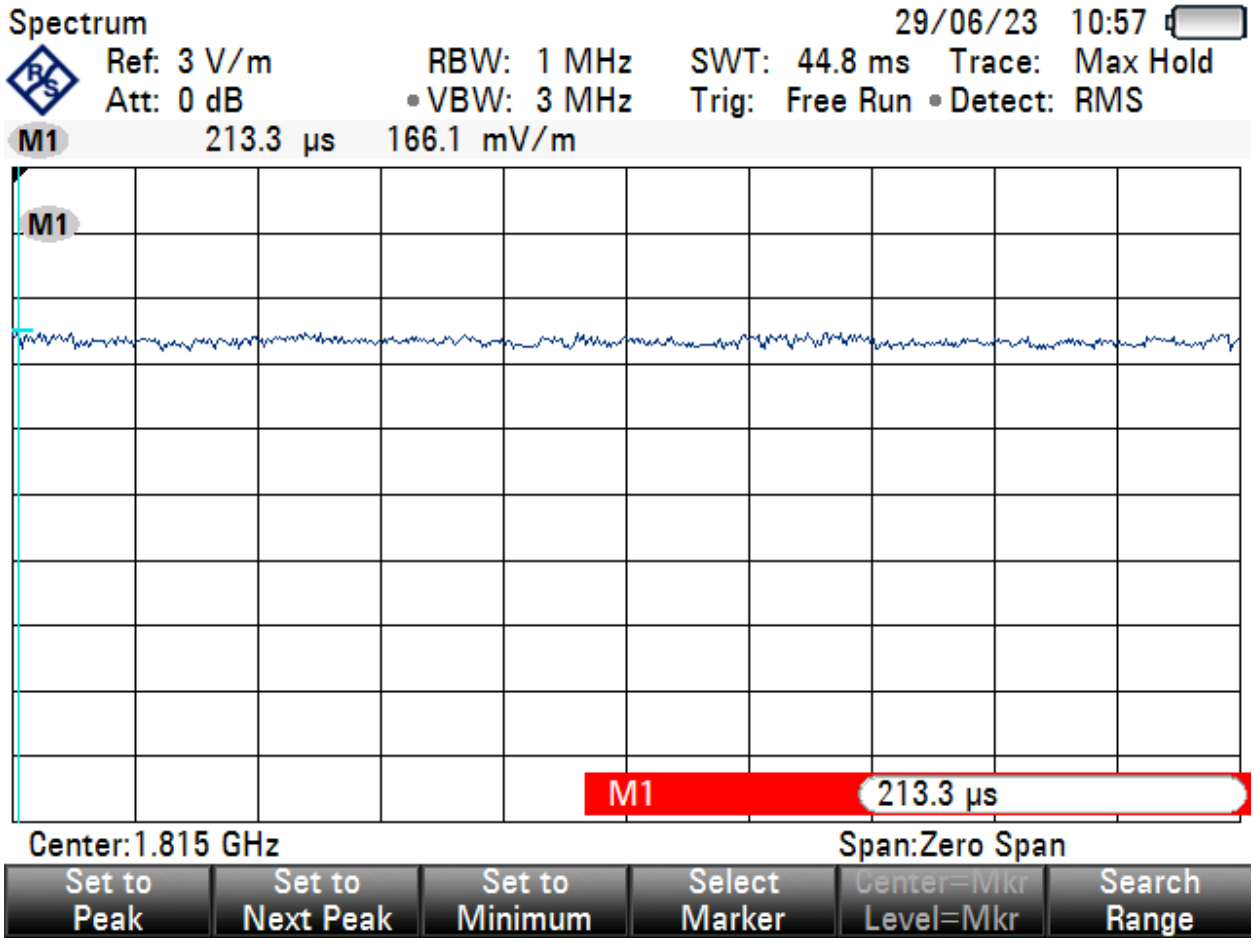
LTE Downlink Signals Detected in Band:



Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 1815 MHz:

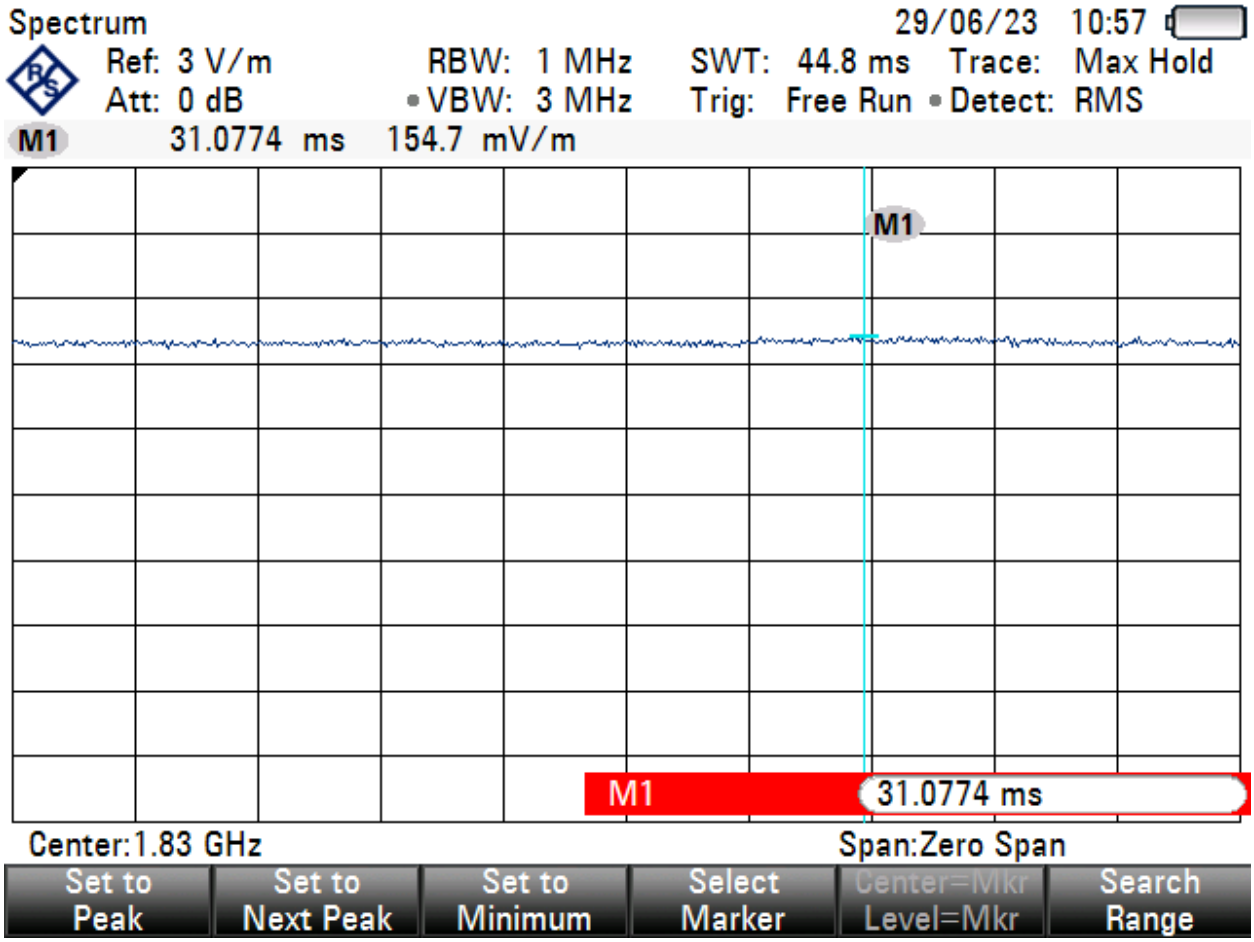


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	1815.000	0.166100	3.50	0.581889	58.6	100.670

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 1830 MHz:

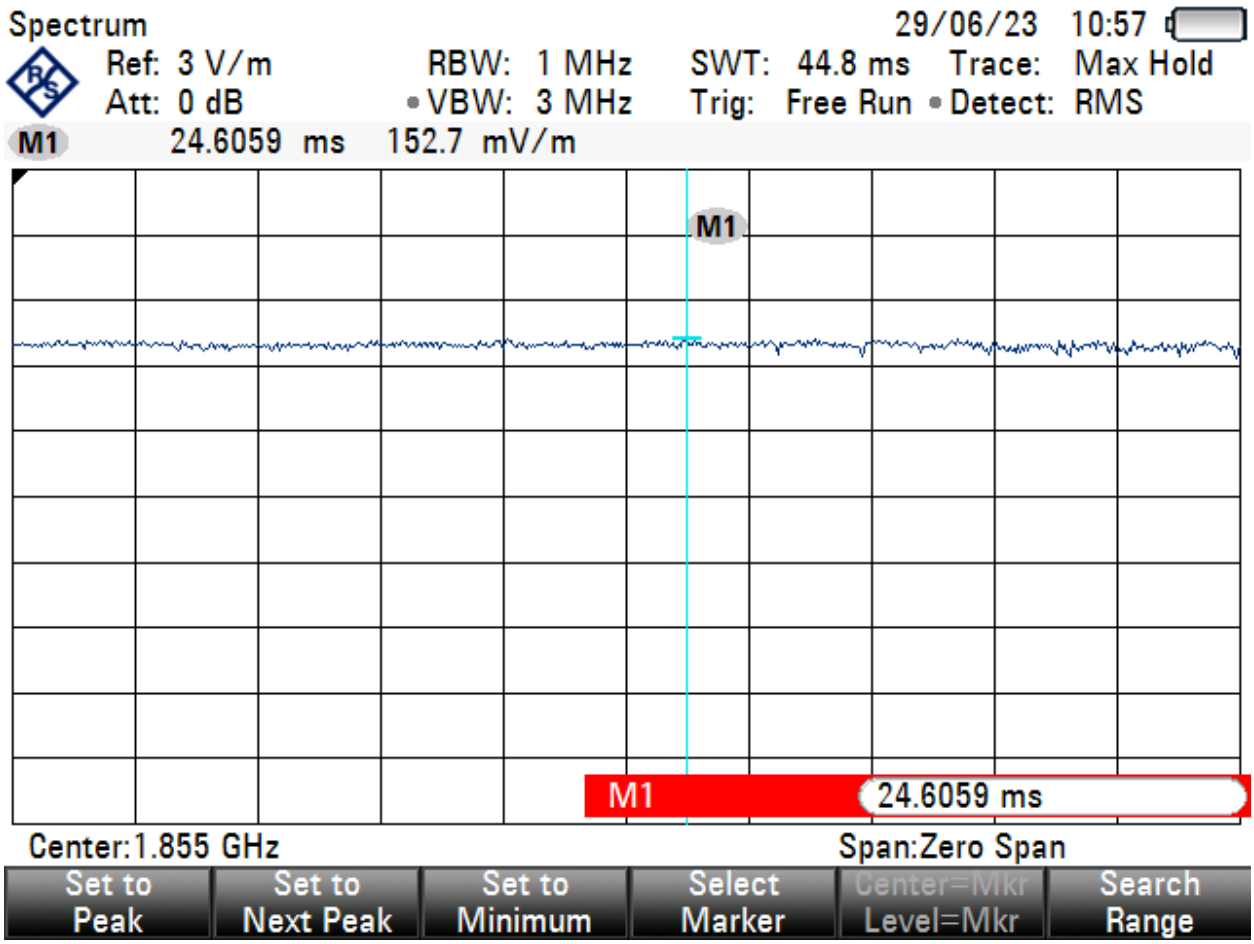


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	1830.000	0.154700	4.05	0.625792	58.8	93.994

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 1855 MHz:

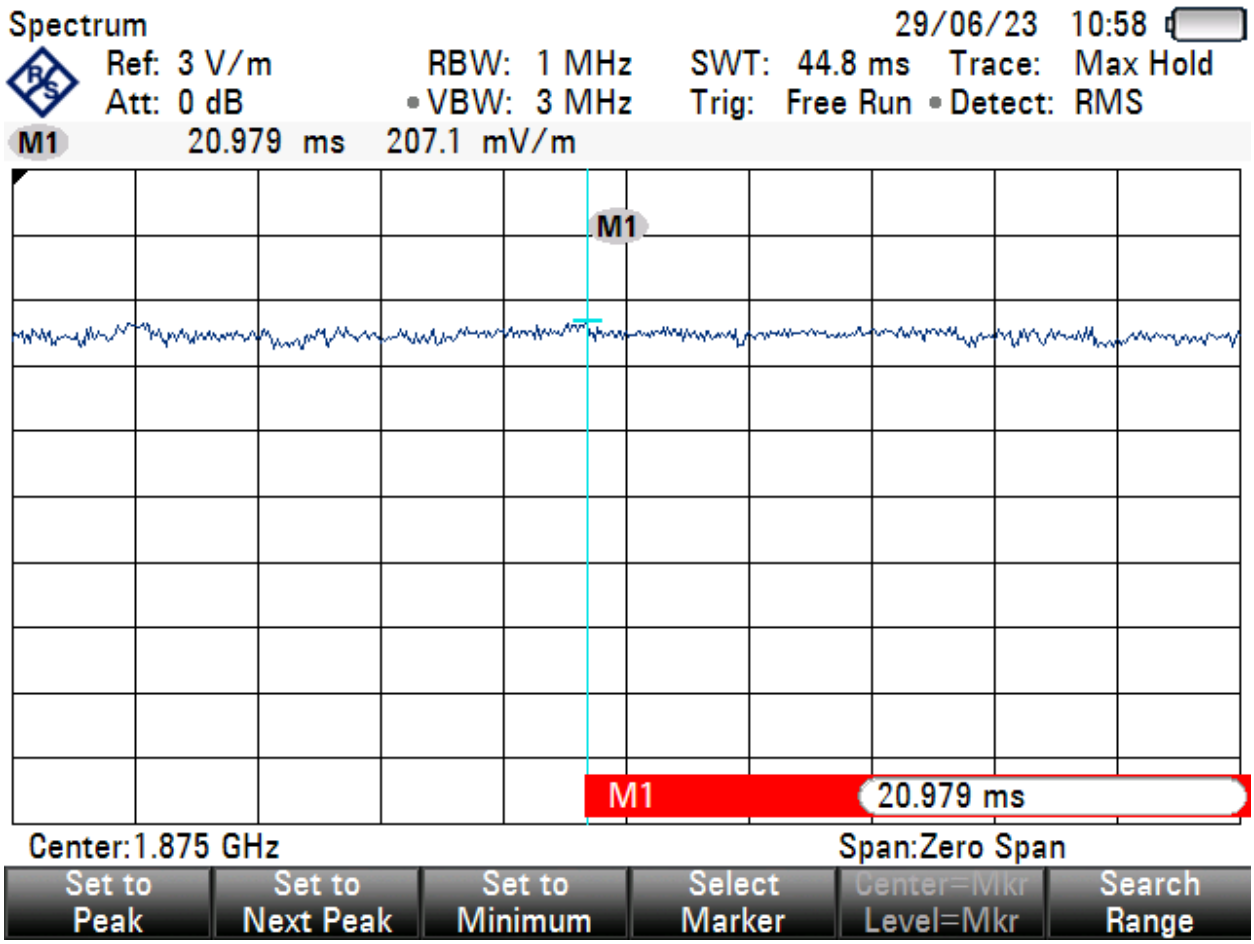


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	1855.000	0.152700	4.05	0.617702	59.2	95.873

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 1875 MHz:

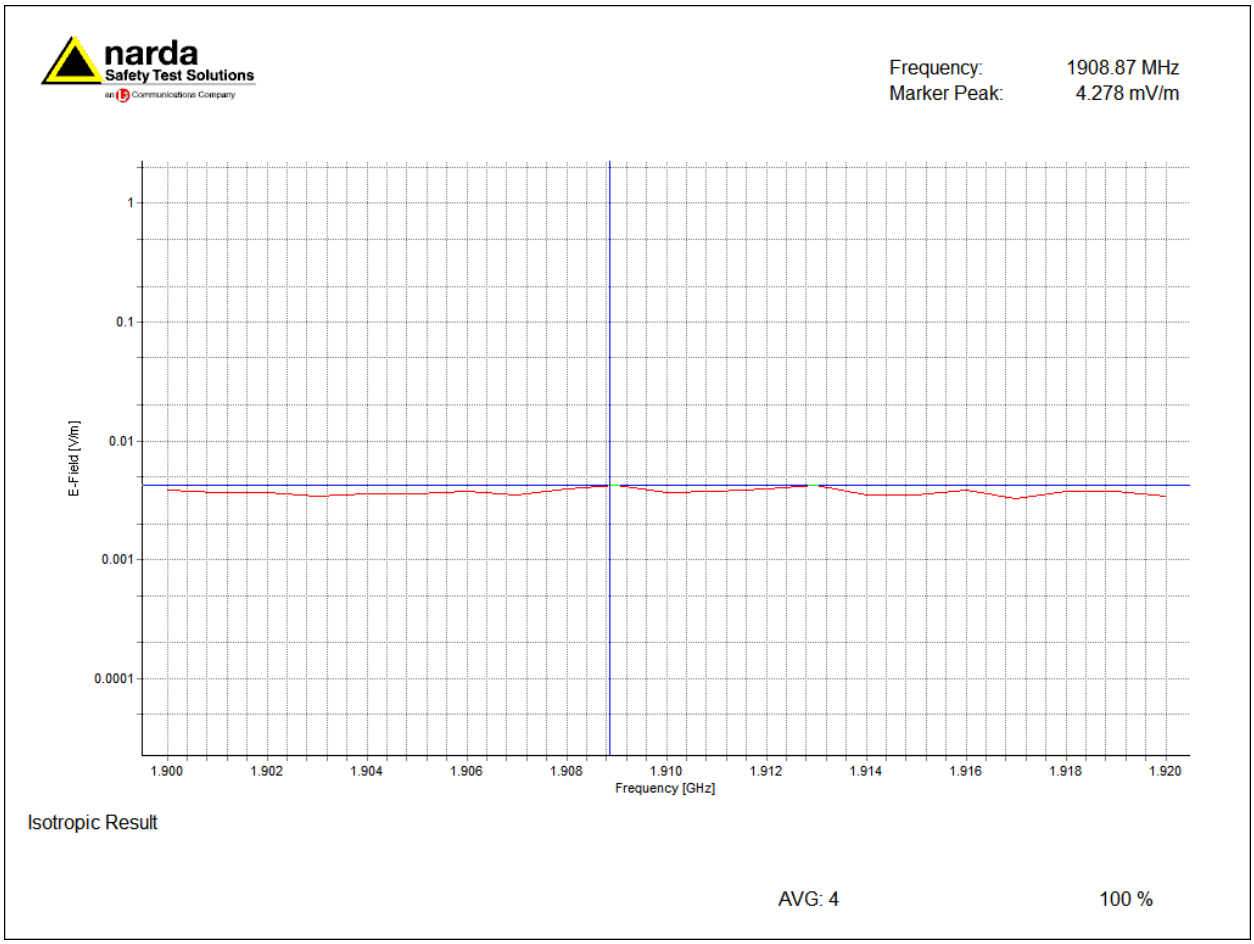


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	1875.000	0.207100	3.50	0.725522	59.5	82.064

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results	1900 UMTS TDD Band	1900 - 1920 MHz



No measurable signal detected

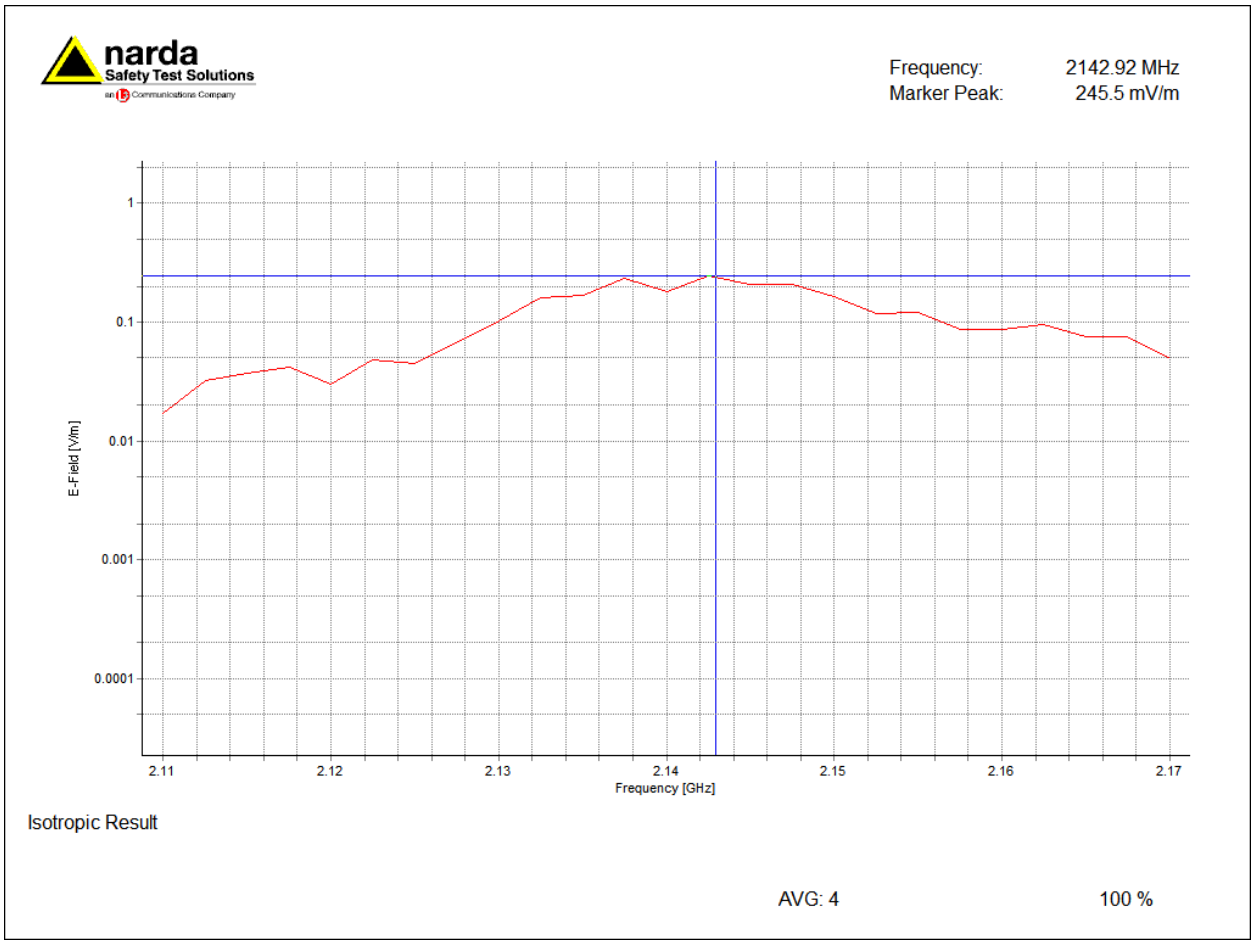
Trace Mode	Actual	RBW	2 MHz	Detector	MAX (Peak Value)

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	2.1 GHz Band	2110 - 2170 MHz

UMTS Measurements 2110 – 2170 MHz



No measurable signal detected

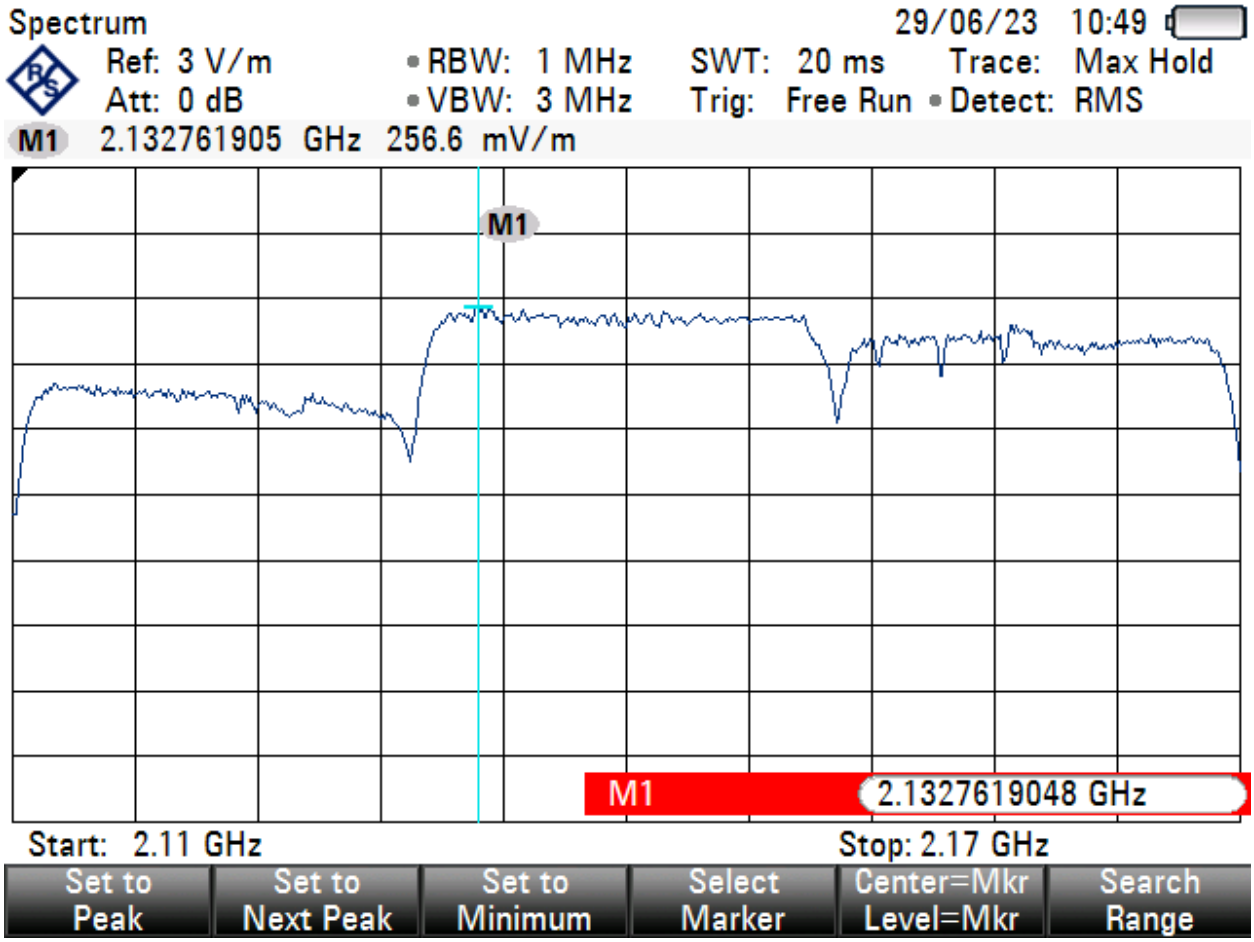
Trace Mode	Actual	RBW	5 MHz	Detector	AVERAGE (RMS)

Receiver		Antenna	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

LTE Measurements **2110 – 2170 MHz**

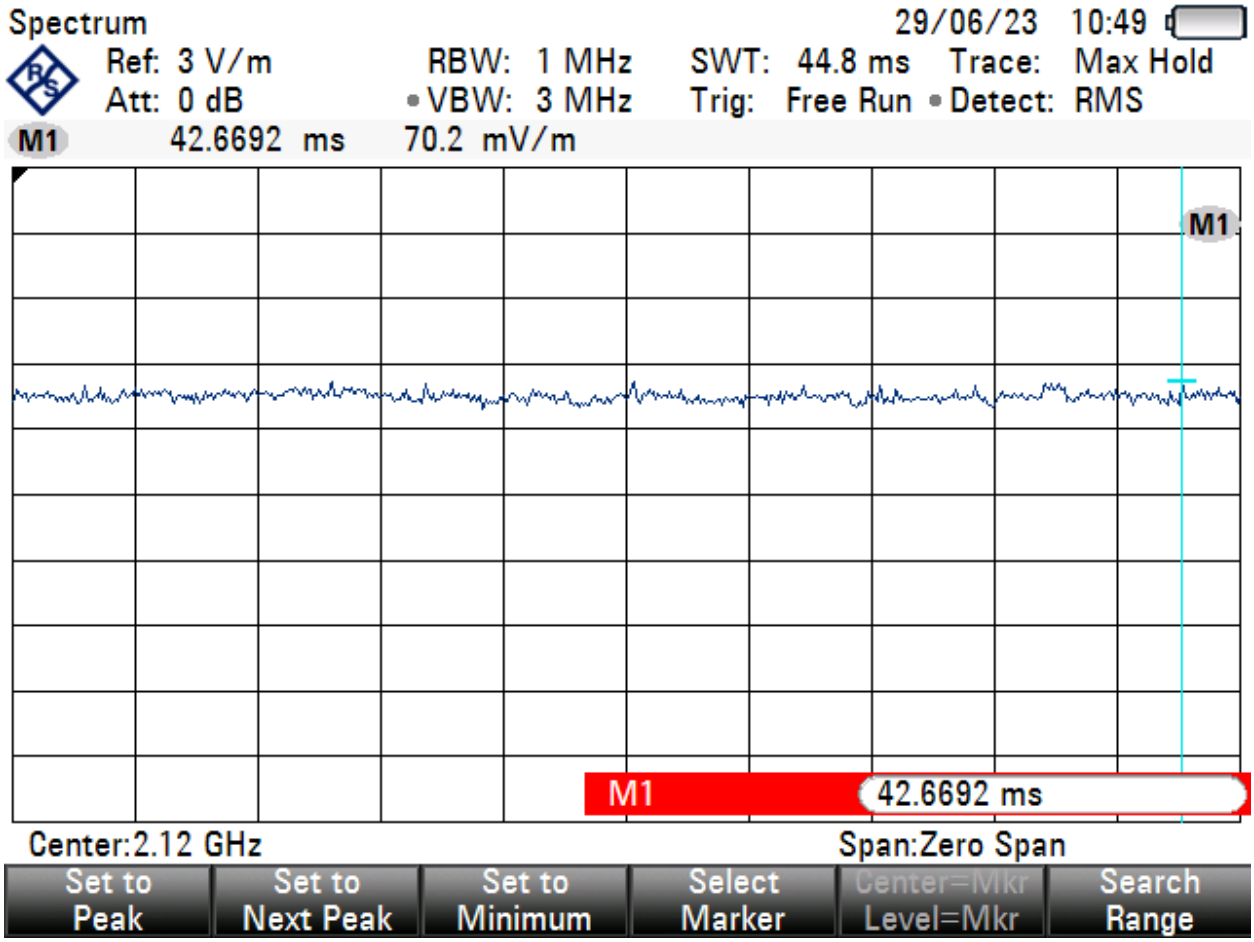
LTE Downlink Signals Detected in Band:



Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 2120.000 MHz:

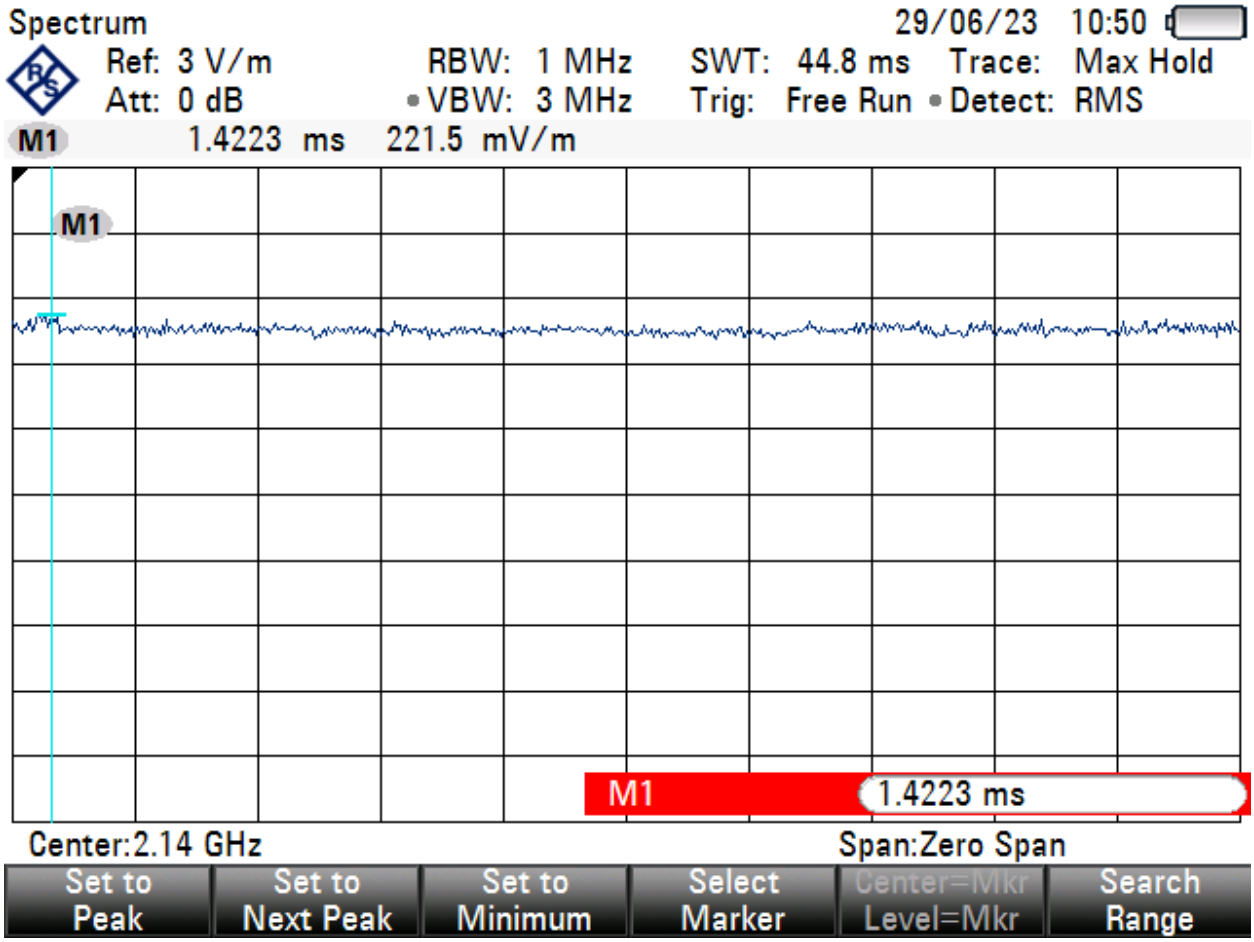


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	2120.000	0.070200	4.26	0.299052	61.0	203.978

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 2140.000 MHz:

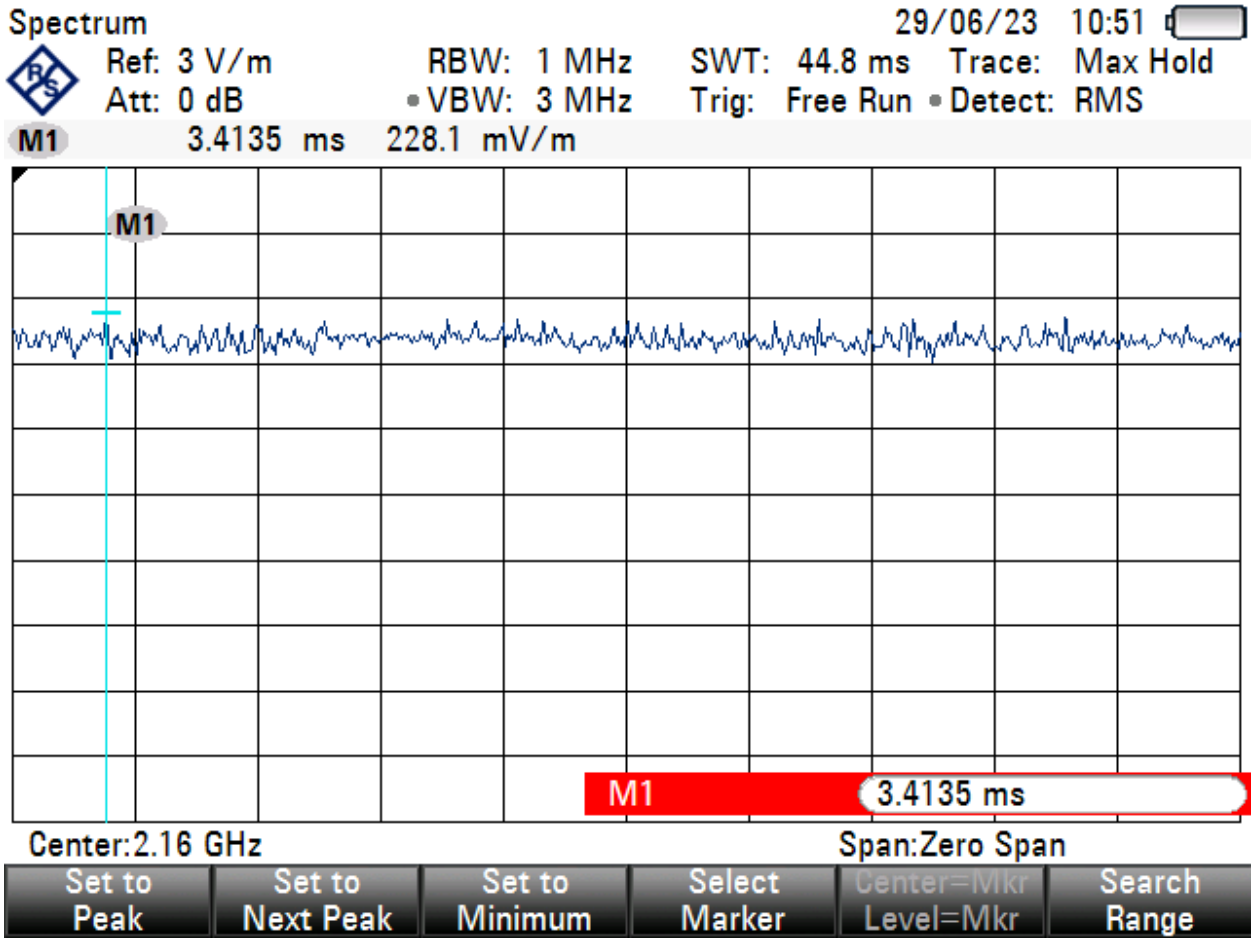


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	2140.000	0.221500	4.26	0.943590	61.0	64.647

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Time Domain Measurement of LTE Signal on 2160.000 MHz:

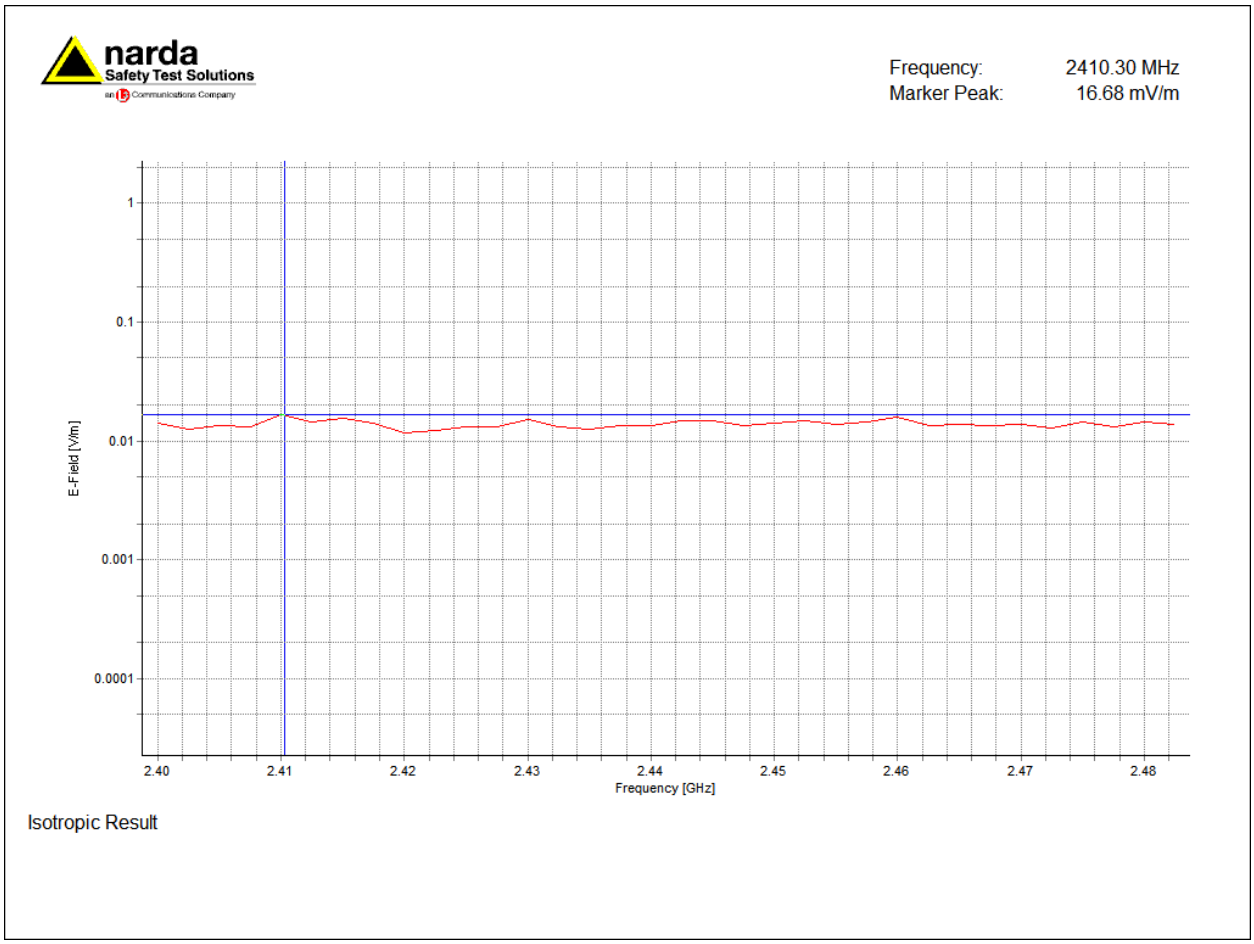


			Adjusted E-Field			
Emission Type	**Frequency (MHz)**	**Measured Level (V/m)**	**Max Traffic Extrapolation Factor**	**Adjusted Level (V/m)**	**ICNIRP LIMIT (V/m)**	**Times Below Limit**
LTE	2160.000	0.228100	4.26	0.971706	61.0	62.776

Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results	WiFi 2.4 GHz Band	2400 – 2483.5 MHz



No measurable signal detected

Trace Mode	Max Hold	**RBW**	5 MHz	**Detector**	MAX (Peak Value)

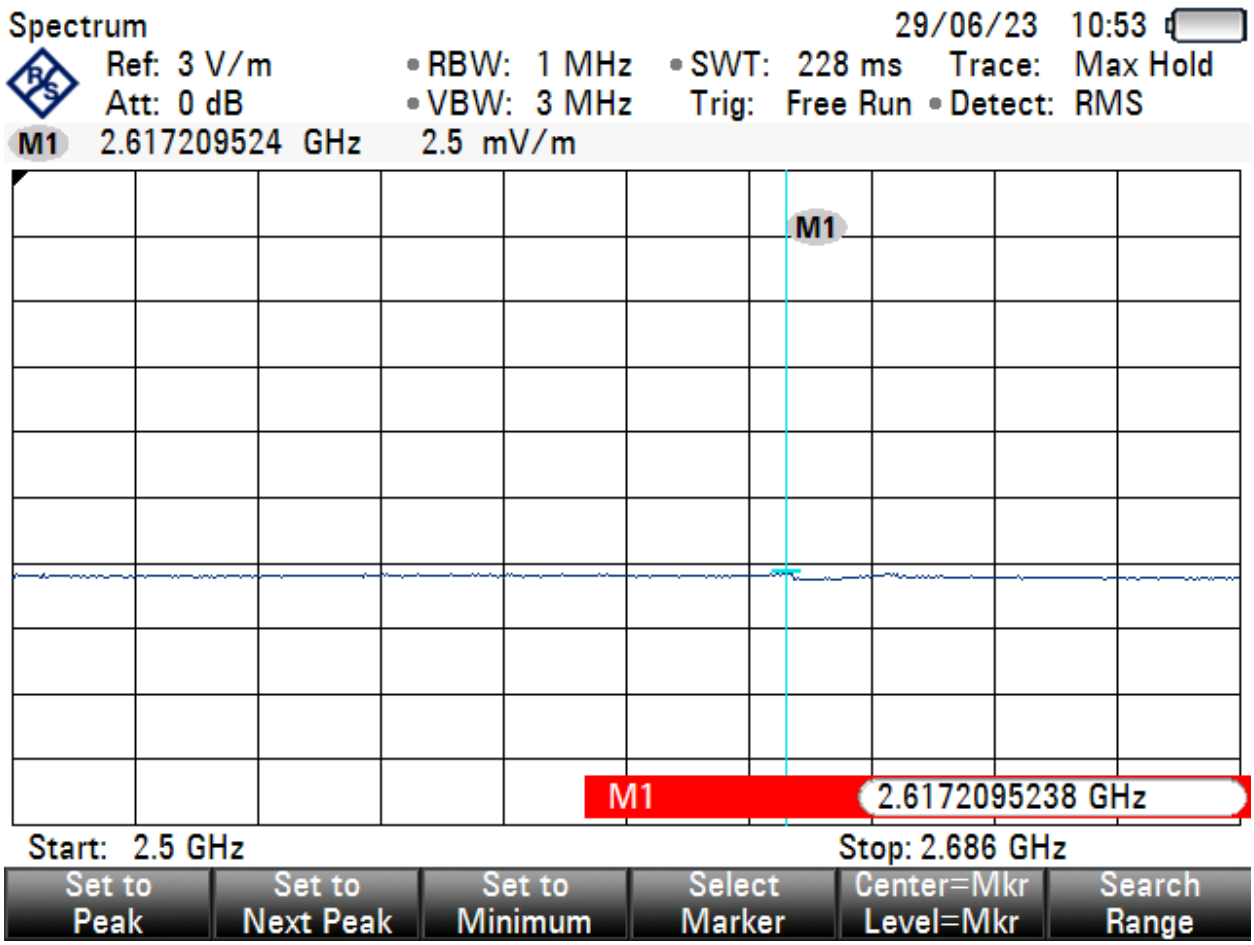
Receiver		**Antenna**	
Manufacturer	Narda	**Manufacturer**	Narda
Model	SRM 3000	**Model**	SRM 3-Axis Antenna
Serial Number	M-0082	**Serial Number**	H-0254
Calibration Date	22/02/2023	**Calibration Date**	22/02/2023

Measurement Uncertainty	
Expanded Uncertainty (dB)	**+2.4 / -3.3 dB**

Spectrum Analyser Results	2.6 GHz Band	2500 –2686 MHz

LTE Measurements **2500 – 2686 MHz**

LTE Downlink Signals Detected in Band:



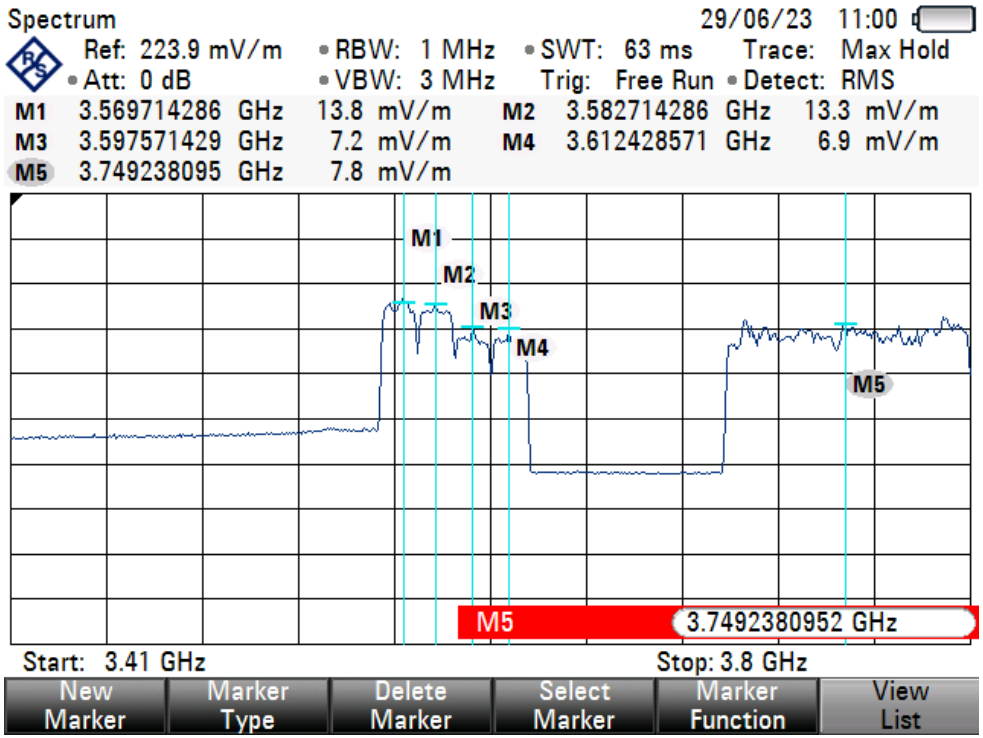
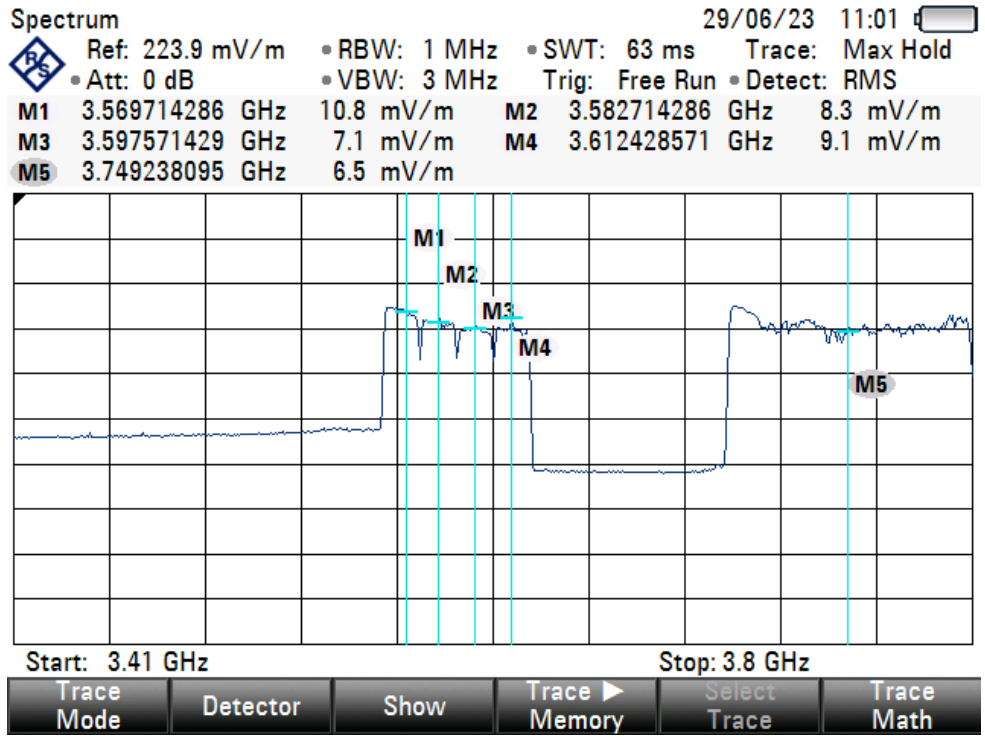
No measurable signal detected

Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	Rohde & Schwarz
Model	FSH20	**Model**	TS-EMF
Serial Number	120532	**Serial Number**	100049
Calibration Date	16/05/2023	**Calibration Date**	15/07/2020

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results	3 GHz Band	3410 - 3800 MHz

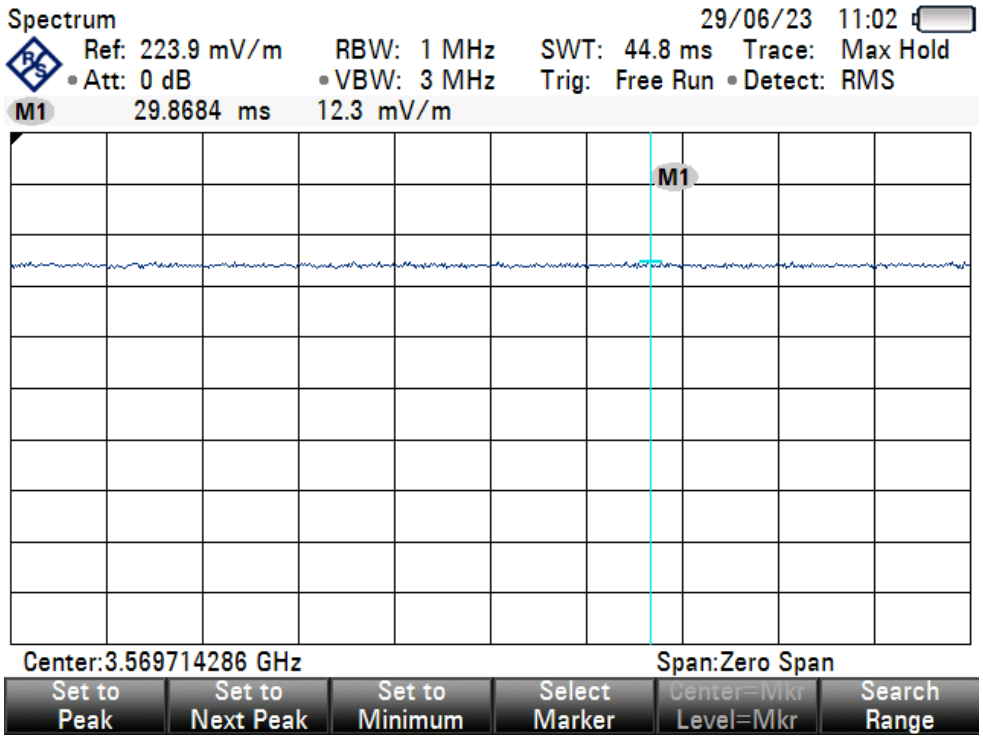
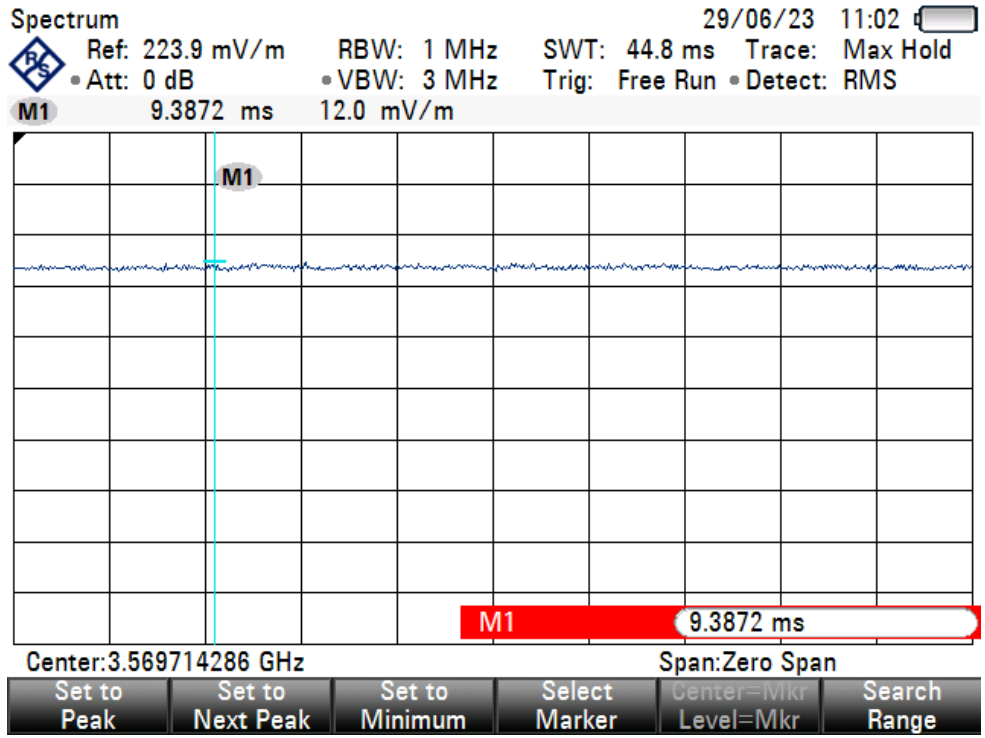
Frequency Domain scan of Band

Antenna V-Pol	Antenna H-Pol
	

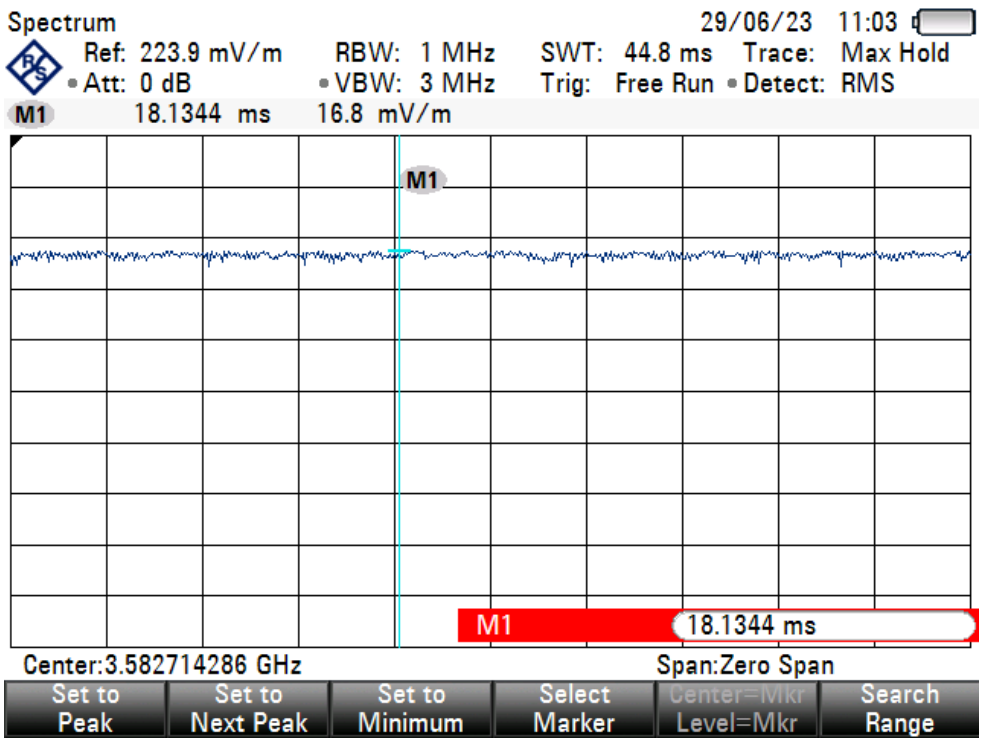
Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

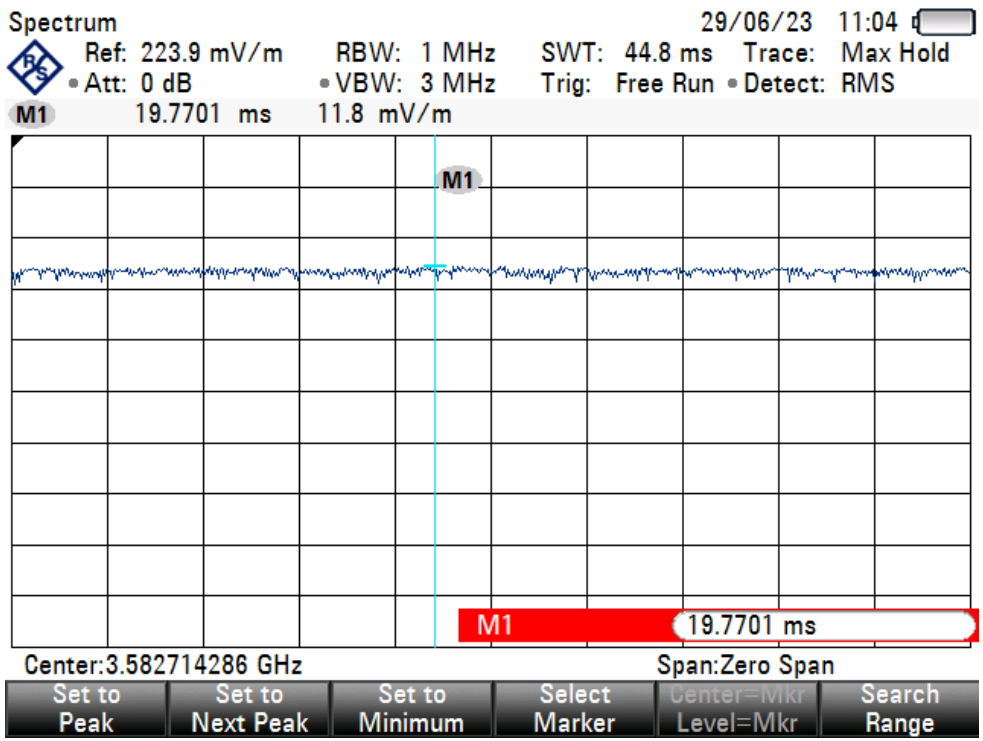
Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

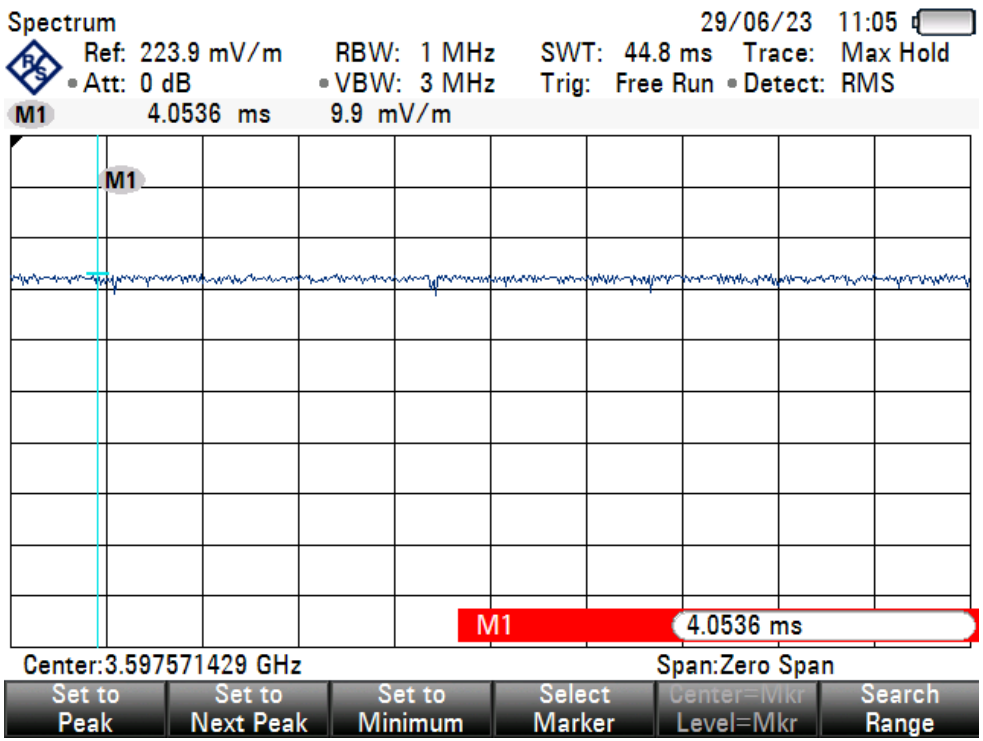
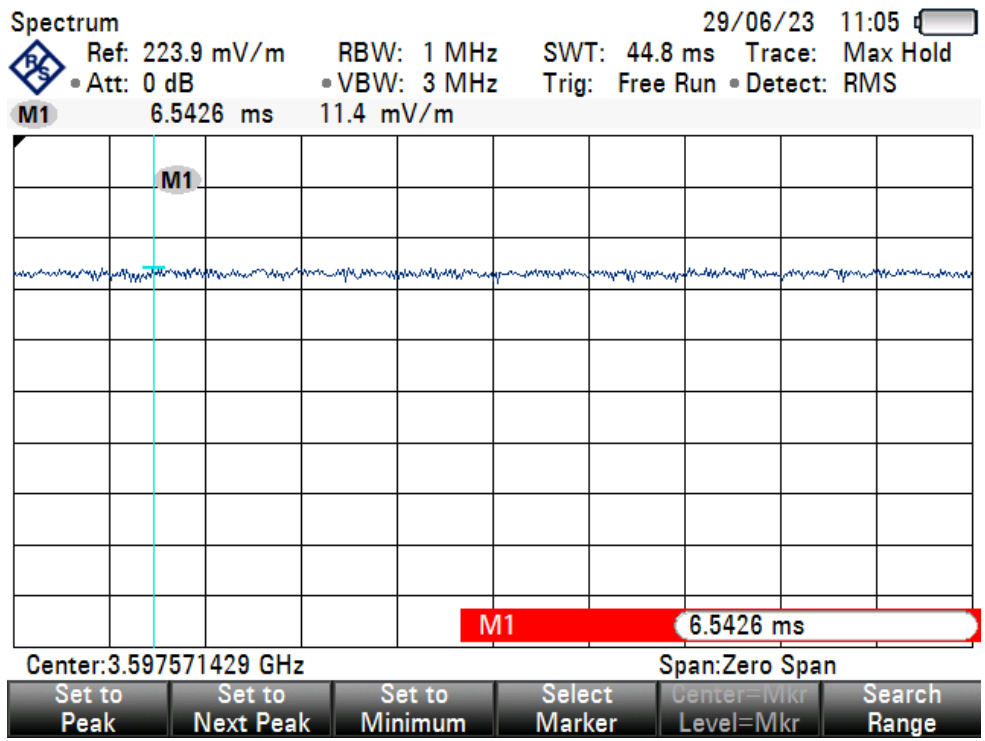
Zero Span Measurements of LTE Signals in Band

3,569.714 MHz	
Antenna V-Pol	**Antenna H-Pol**
	

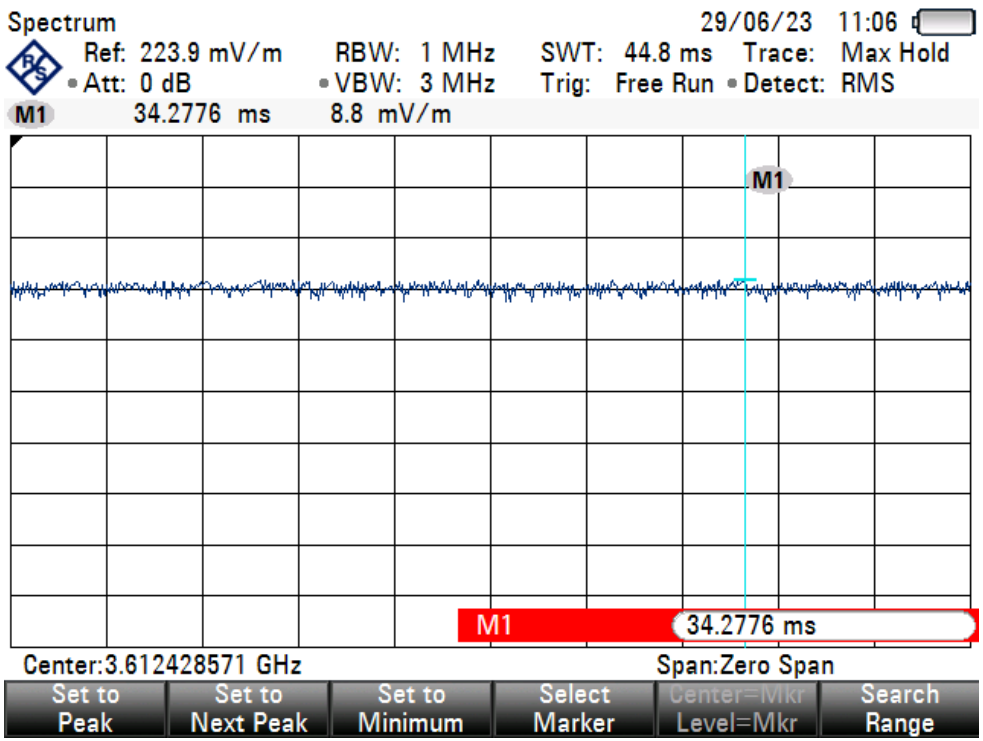
3,582.714 MHz	
Antenna V-Pol	**Antenna H-Pol**

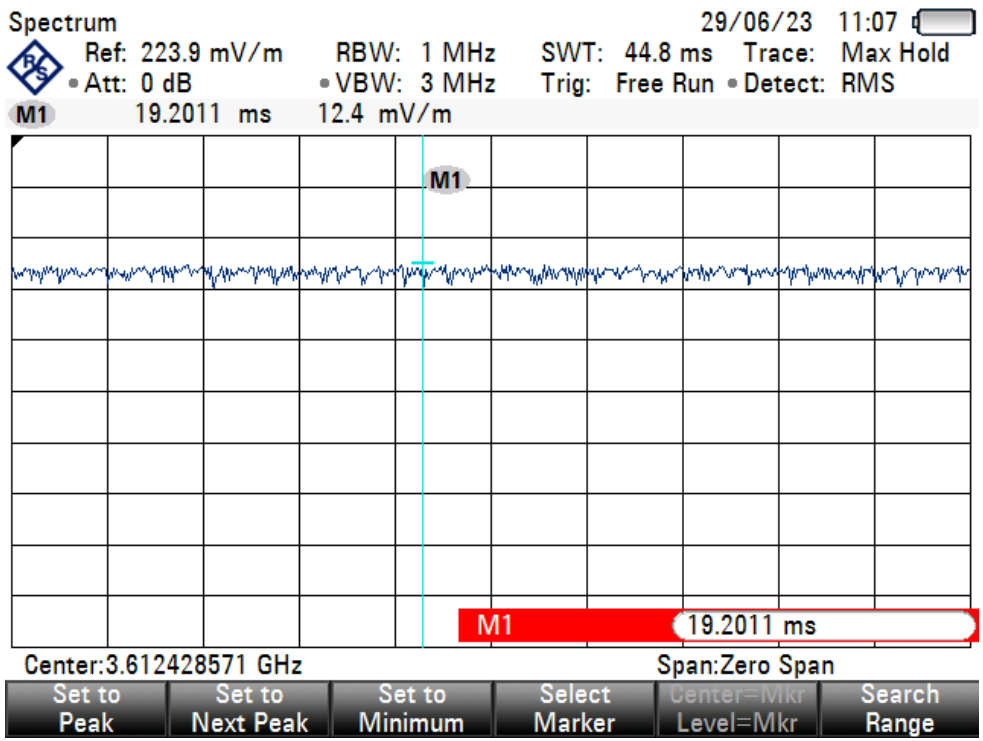




3,597.571 MHz	
Antenna V-Pol	**Antenna H-Pol**
	

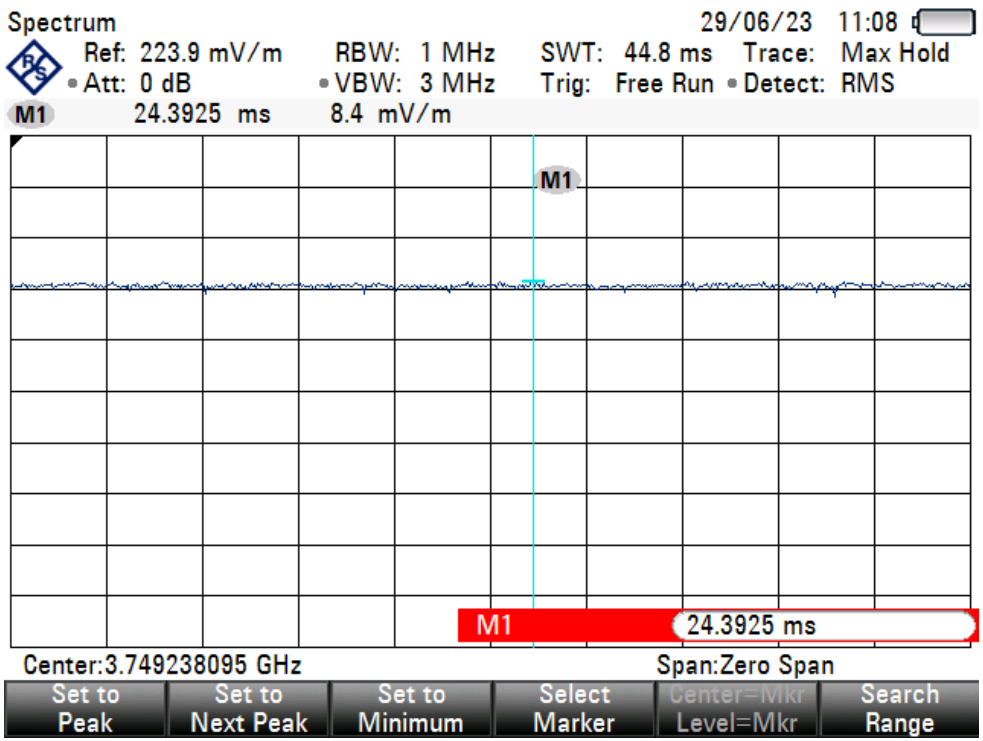
3,612.429 MHz	
Antenna V-Pol	**Antenna H-Pol**



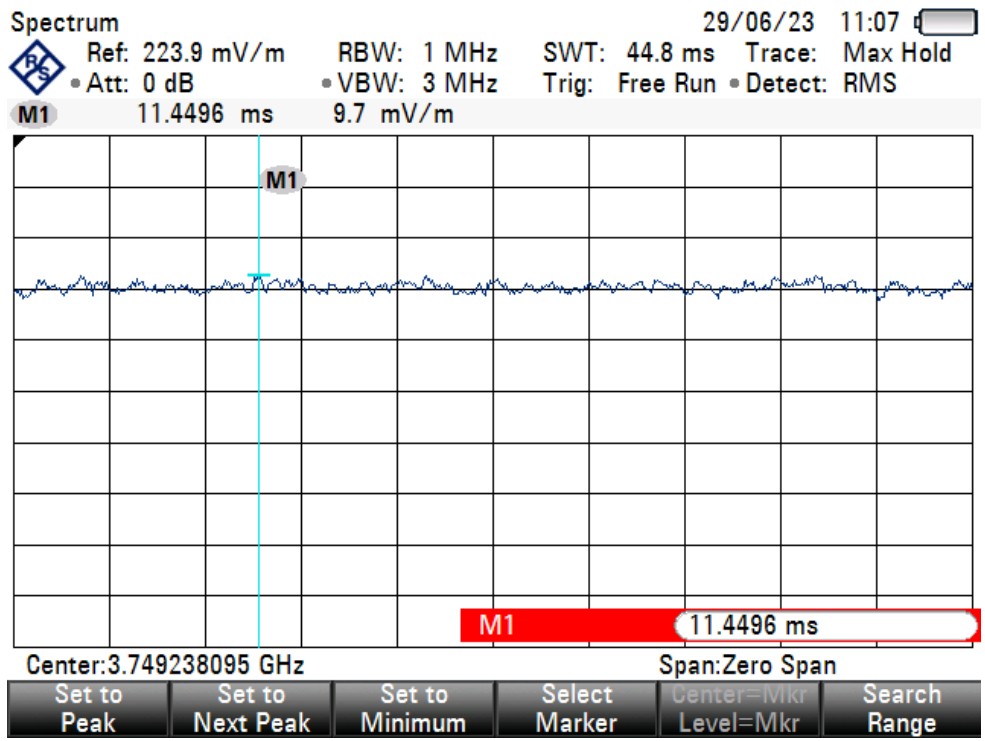


3,749.238 MHz

Antenna V-Pol



Antenna H-Pol



		Measured Level			Adjusted E Field				
Emission Type	Frequency (MHz)	V-Pol (V/m)	H-Pol (V/m)	Total (V/m)	RBW Correction Factor	Max Duty Cycle Extrapolation Factor	Est. Max Duty Cycle Level (V/m)	ICNIRP LIMIT (V/m)	Times Below Limit
LTE	3569.714	0.012300	0.012000	0.017184	3.69	1.00	0.063409	61	962.009
LTE	3582.714	0.016800	0.011800	0.020530	9.59	1.00	0.196882	61	309.829
LTE	3597.571	0.009900	0.114000	0.114429	9.59	1.00	1.097375	61	55.587

LTE	3612.429	0.008800	0.012400	0.015205	9.59	1.00	0.145818	61	418.328
LTE	3749.238	0.008400	0.009700	0.012832	9.53	1.00	0.122285	61	498.834

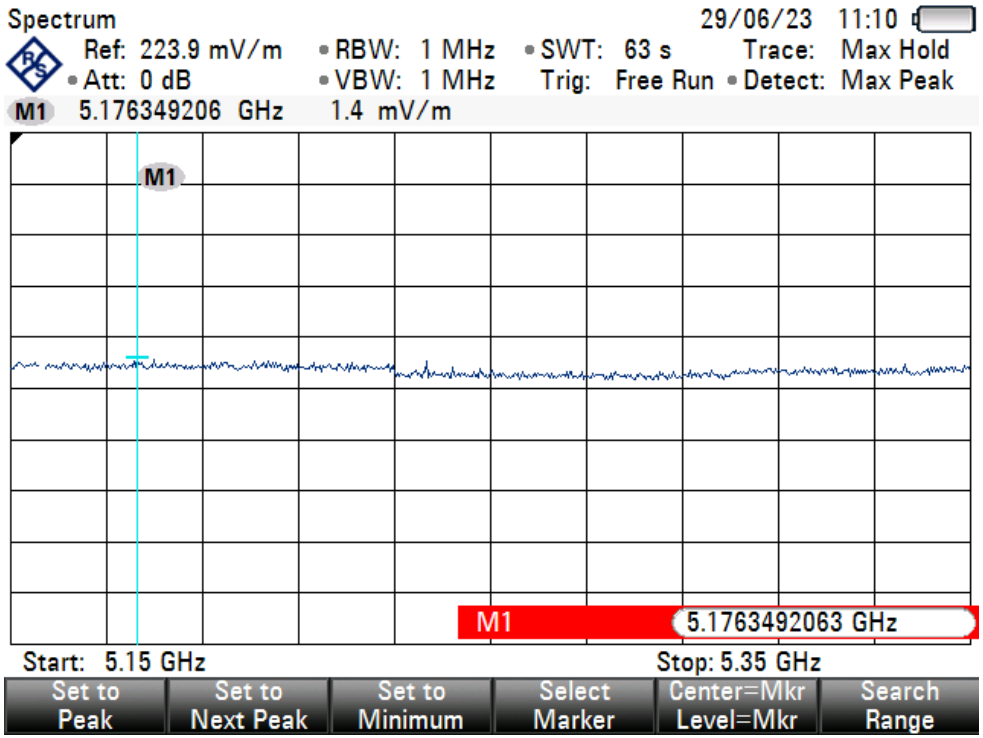
Receiver		**Antenna**	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

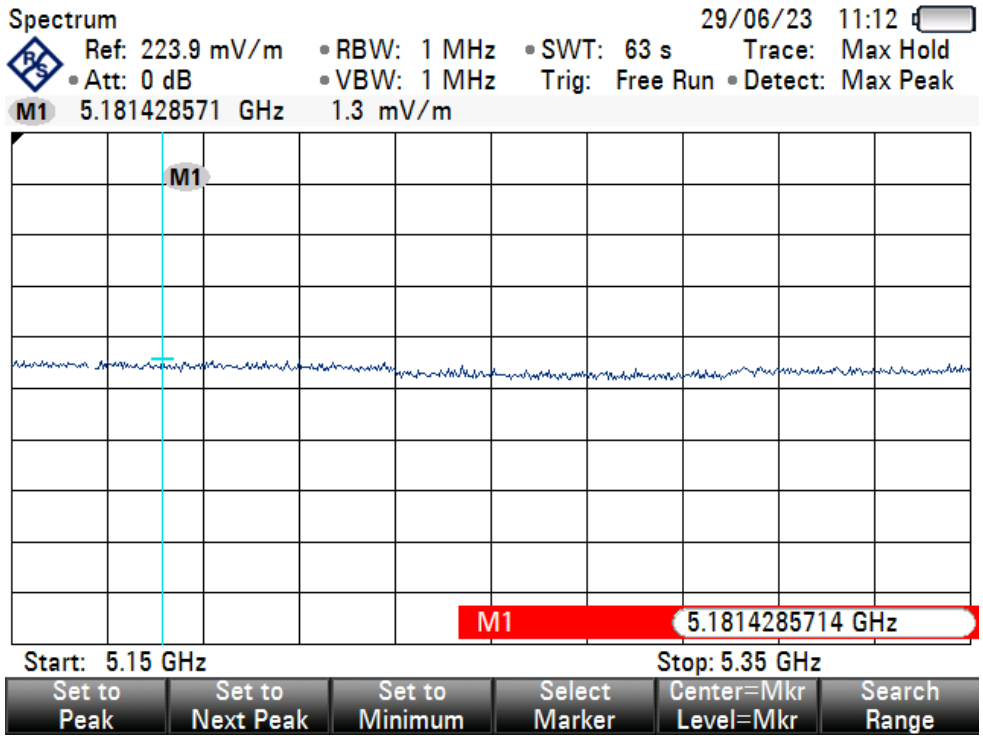
Spectrum Analyser Results	WiFi 5 GHz	5150 – 5350 MHz

Frequency Domain scan of Band

Antenna V-Pol



Antenna H-Pol



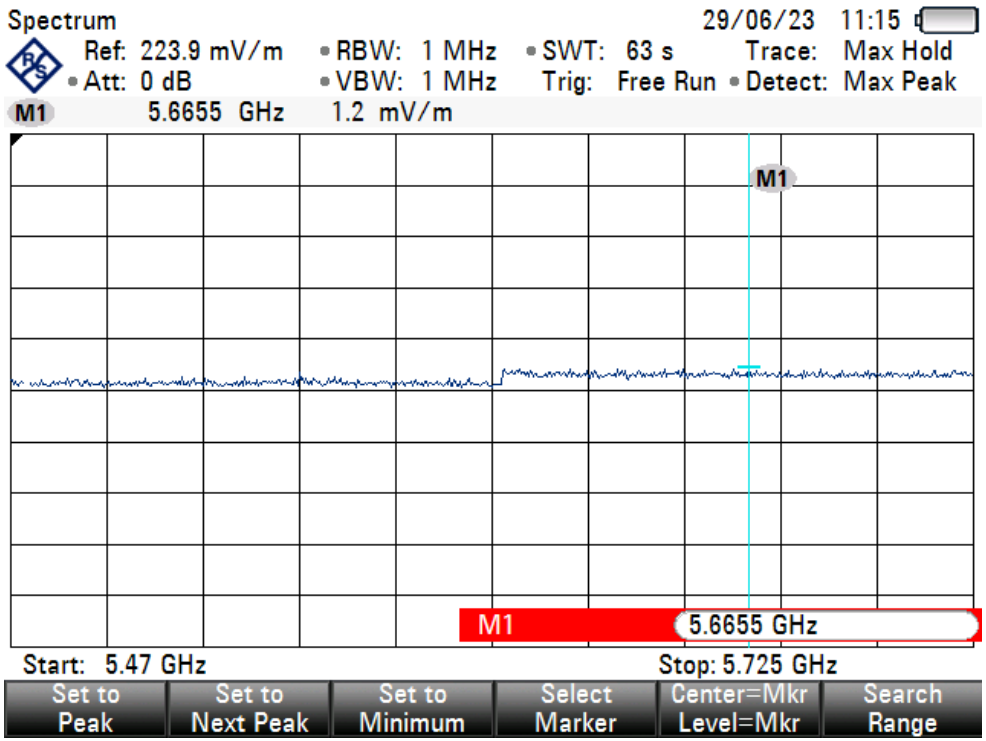
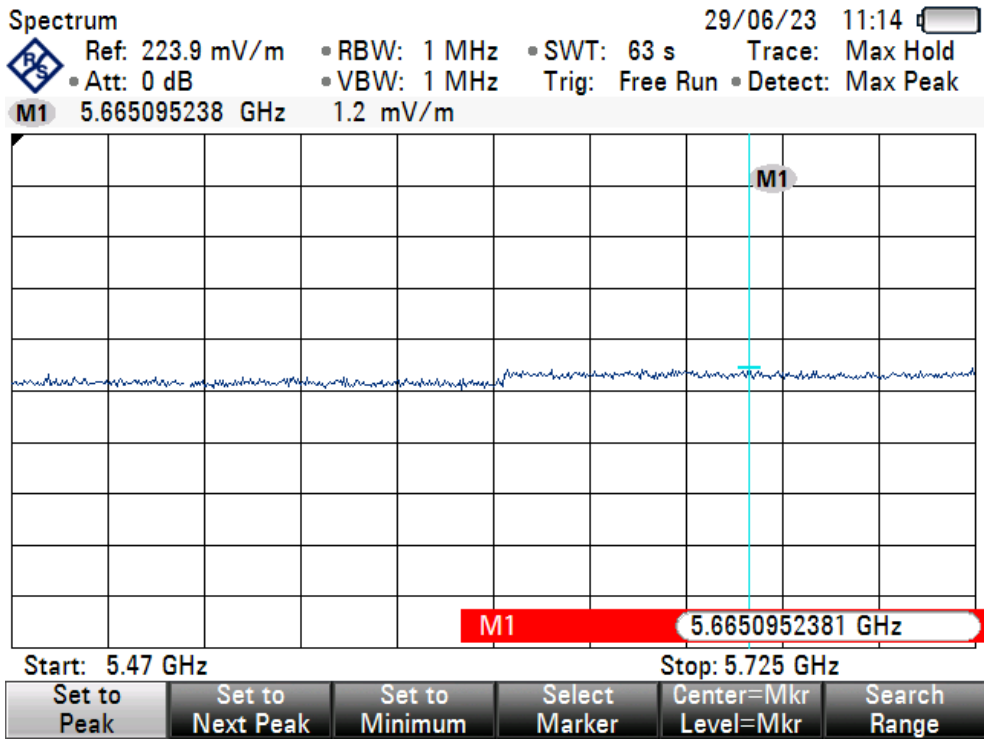
No measurable signal detected

Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

Spectrum Analyser Results	WiFi 5 GHz	5470 – 5725 MHz

Frequency Domain scan of Band

Antenna V-Pol	Antenna H-Pol
	

No measurable signal detected

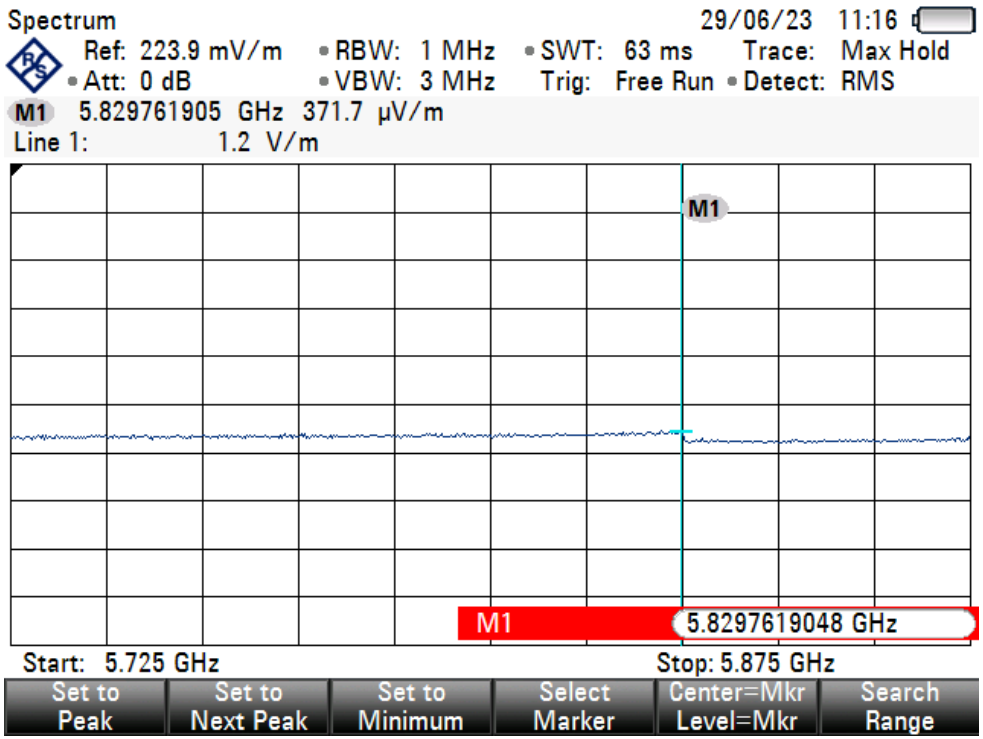
Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

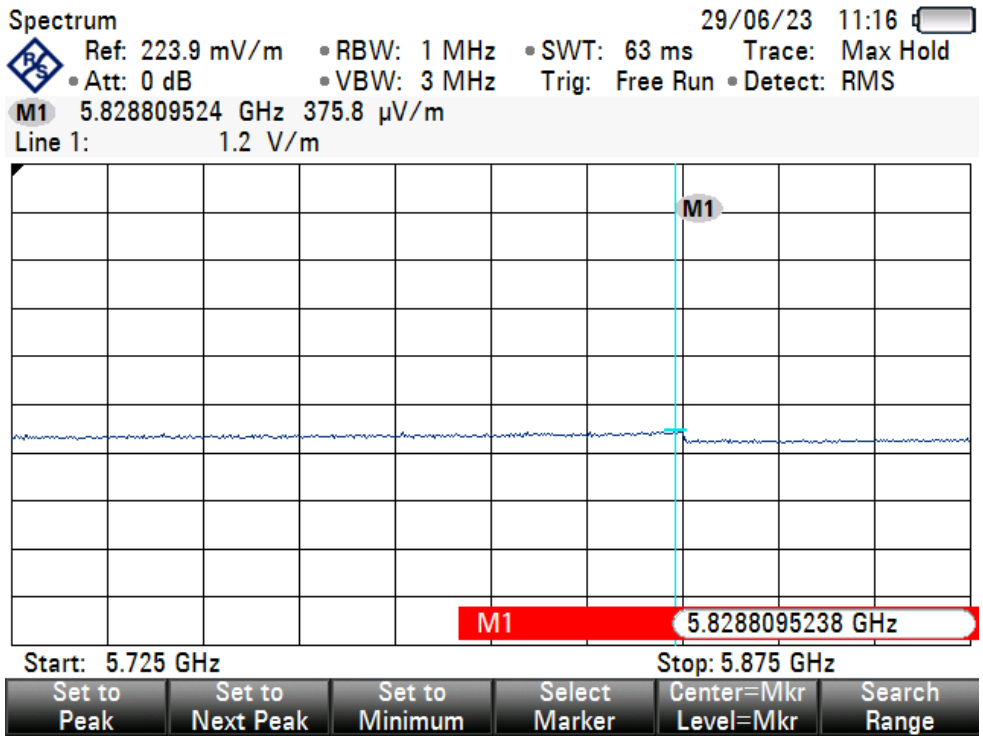
Spectrum Analyser Results	BWA Licence Exempt Band	5725 – 5875 MHz

Frequency Domain scan of Band

Antenna V-Pol



Antenna H-Pol



No measurable signal detected

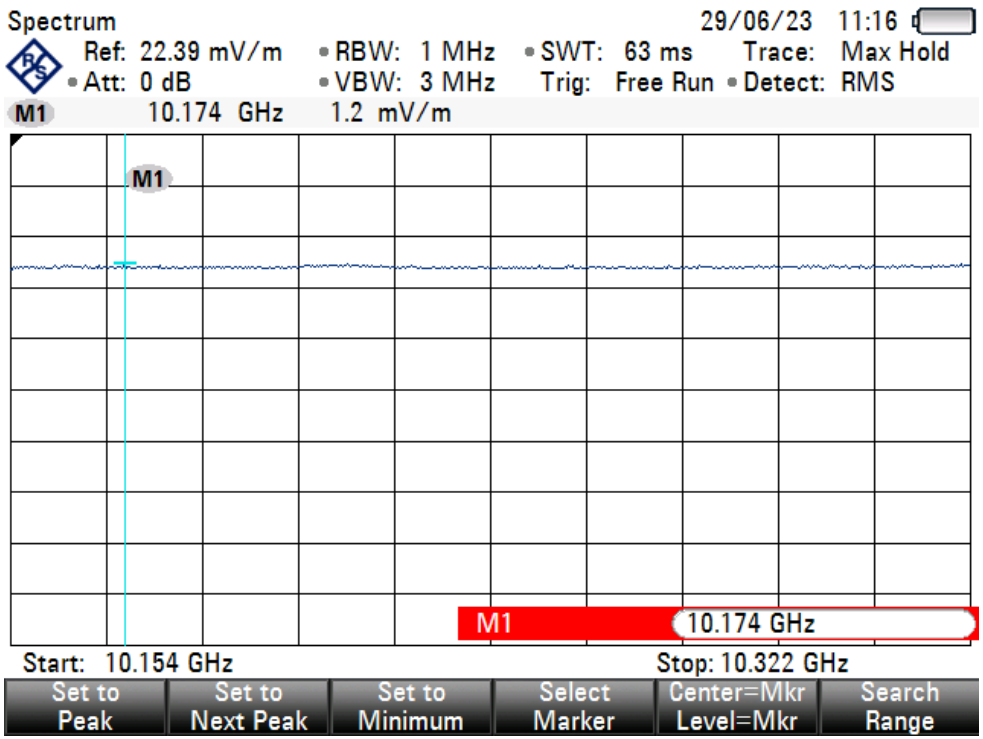
Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

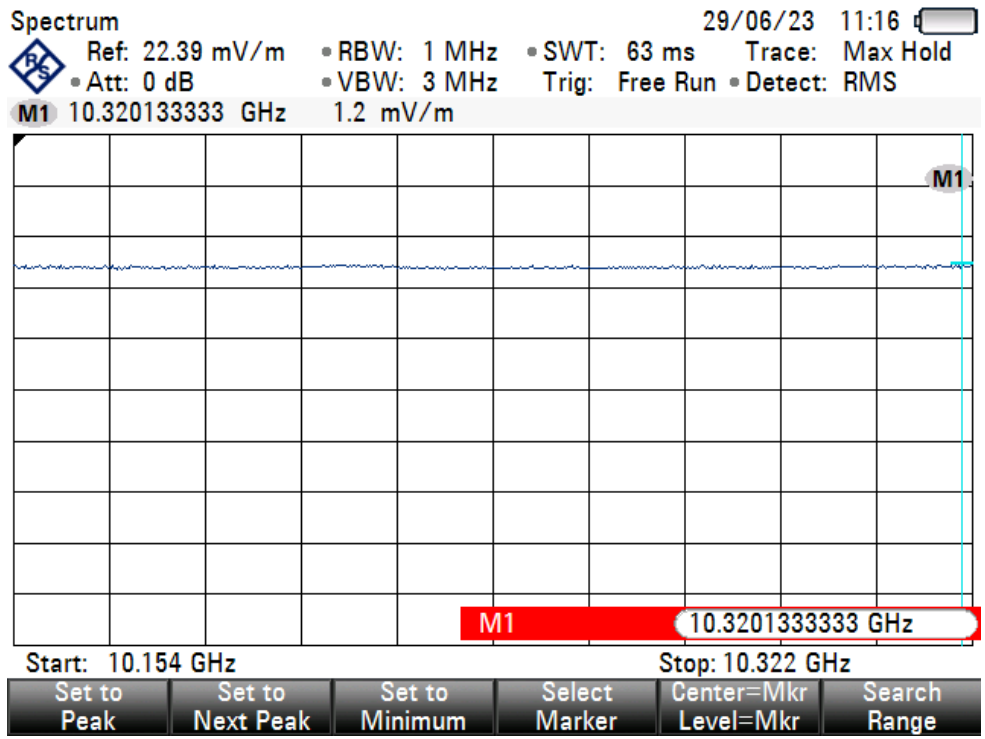
Spectrum Analyser Results	BWA 10 GHz Band	10154 - 10322 MHz

Frequency Domain scan of Band

Antenna V-Pol



Antenna H-Pol



No measurable signal detected

Receiver		Antenna	
Manufacturer	Rohde & Schwarz	**Manufacturer**	EMCO
Model	FSH20	**Model**	3115
Serial Number	120532	**Serial Number**	9905-5809
Calibration Date	16/05/2023	**Calibration Date**	21/01/2022

Measurement Uncertainty			
Input	**Uncertainty(dB) Conf interval of 95%**	**Uncertainty(num) Conf interval of 95%**	**u(xi) Standard uncertainty (num.) Conf interval of 66%**
Antenna Factor	1.00	0.12	0.06
Spectrum Analyser	0.20	0.02	0.01
Cable	0.10	0.01	0.01
		Combined Standard Uncertainty (dB)	**0.526**
		Expanded Uncertainty (dB)	**1.002**

1. Measurement Equipment List

Field Strength Meter

Manufacturer:	Narda
Model:	NBM-550
Serial Number:	A-0068
Calibration Date:	23/05/2023

3 GHz Probe

Manufacturer:	Narda
Model:	EF 0391
Serial Number:	A-0119
Calibration Date:	24/05/2023
Frequency Range:	100 kHz – 3 GHz

40 GHz Probe

Manufacturer:	Narda
Model:	EF 4091
Serial Number:	A-0110
Calibration Date:	24/05/2023
Frequency Range:	27 MHz – 40 GHz

Frequency Selective Measurements

See individual band scans in previous section for details of antennas and spectrum analysers used.

2. Site Photographs

Photo 1. Broadband Measurement location looking towards antennas

Photo 2. Frequency selective measurement location looking towards antennas

APPENDIX 1 – SUMMARY OF THE ICNIRP GUIDELINES

SUMMARY OF THE ICNIRP GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHz)

ICNIRP

The International Commission on Non-Ionizing Radiation Protection (**ICNIRP**)[12] is a non-governmental organisation formally recognised by the World Health Organisation. ICNIRP lists among its membership scientific experts in fields relating to non-ionising radiation (**NIR**) protection, such as medicine, dermatology, ophthalmology, epidemiology, biology, photobiology, physiology, physics, electrical engineering and dosimetry.

The functions of ICNIRP are to investigate the hazards that may be associated with the different forms of NIR, develop international guidelines on NIR exposure limits, and deal with all aspects of NIR protection.

ICNIRP provides guidance and recommendations on protection from exposure to NIR. ICNIRP's exposure limits were developed following reviews of peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of biological effects that have been established to have health consequences.

ICNIRP Guidelines

In relation to time-varying electric, magnetic, and electromagnetic fields (**EMF**) (up to 300 GHz) ICNIRP has published two sets of guidelines:

- *"Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz - 100 kHz)"*, Health Physics 99(6):818-836; 2010[13]. **("ICNIRP 2010 Guidelines")**; and
- *"Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz)"*, Health Physics 118 (5): 483-524; 2020[14]. (**"ICNIRP 2020 Guidelines")**.

The ICNRIP 2010 Guidelines and ICNIRP 2020 Guidelines replace the previous recommendations given in the ICNIRP 1998 Guidelines for the frequency range 1 Hz to 300GHz.

In each of the above guidelines, ICNIRP has defined two sets of guideline exposure limits: (i) for members of the general public and (ii) for people classified as occupational (e.g. engineers working on a

[12] For further information see www.icnirp.org.
[13] https://www.icnirp.org/cms/upload/publications/ICNIRPLFgdl.pdf
[14] https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf

transmitter). The occupationally exposed population consists of adults who are generally exposed under known conditions and are trained to be aware of potential risk and to take appropriate precautions.

In contrast, the general public comprises individuals of all ages and of varying health status and may include particularly susceptible groups or individuals. In many cases, members of the public are unaware of their exposure to EMF. Moreover, individual members of the public cannot reasonably be expected to take precautions to minimise or avoid exposure. It is these considerations that underlie the adoption of more stringent exposure restrictions for the public than for the occupationally exposed population.

ICNIRP Limits - Basic Restrictions and Reference Levels

ICNIRP has defined exposure limits in terms of “basic restrictions” and “reference levels”.

Depending on frequency, the physical quantities used to specify the **basic restrictions** on exposure to EMFs are current density, specific absorption rate (SAR), and power density. As SAR is not easily measurable in living people, reference levels have been obtained from the basic restrictions by mathematical modelling and by extrapolation from the results of laboratory investigations at specific frequencies.

Reference levels are provided for comparison with measured values of physical quantities. Compliance with all reference levels identified in the ICNIRP guidelines ensure compliance with the basic restrictions. If measured values are higher than reference levels, it does not necessarily follow that the basic restrictions have been exceeded, but a more detailed analysis is necessary to assess compliance with the basic restrictions.

The reference levels specified in the ICNIRP 2020 Guidelines relating to limiting exposure to electromagnetic fields are listed in Table 1 **- ICNIRP 2020 Guidelines** reference levels for **occupational** exposure, averaged over 30 minutes and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms values)

(Occupational Exposure) and **Table 2 - ICNIRP 2020 Guidelines** reference levels for **general public** exposure, averaged over 30 minutes and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms value) (General Public Exposure). The reference levels specified in the ICNIRP 2010 guidelines relating to protection against electrical stimulation effects of NIR are listed in Table 3 - ICNIRP 2010 Guidelines reference levels for **occupational** exposure to time-varying electric and magnetic fields (unperturbed rms values)

(Occupational Exposure) and Table 4 (General Public Exposure).

Frequency Range	E – Field Strength E_{inc} (Vm^{-1})	H – Field H_{inc} (Am^{-1})	Incident Power density; S_{inc} (Wm^{-2})
0.1 - 30 MHz	$660/f_M^{0.7}$	$4.9/f_M$	-
>30 – 400 MHz	61	0.16	10
>400 – 2000 MHz	$3f_M^{0.5}$	$0.008f_M^{0.5}$	$f_M/40$
2 – 300 GHz	-	-	50
Note: f in units as indicated in the Frequency Range column			

Table 1 - ICNIRP 2020 Guidelines reference levels for **occupational** exposure, averaged over 30 minutes and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms values)

Frequency Range	E – Field Strength (Vm^{-1})	H – Field (Am^{-1})	Equivalent plane wave power S (Wm^{-2})
0.1 - 30 MHz	$300/f_M^{0.7}$	$2.2/f_M$	-
>30 – 400 MHz	27.7	0.073	2
>400 – 2000 MHz	$1.375\ f_M^{0.5}$	$0.0037f_M^{0.5}$	$f_M/200$
2 – 300 GHz	-	-	10
Note: f in units as indicated in the Frequency Range column			

Table 2 - ICNIRP 2020 Guidelines reference levels for **general public** exposure, averaged over 30 minutes and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms value)

Frequency Range	E – Field Strength E ($kV\ m^{-1}$)	Magnetic Field Strength H ($A\ m^{-1}$)	Magnetic Flux Density B (T)
1 Hz – 8 Hz	20	$1.63 \times 10^5/f^2$	$0.2/f^2$
8 Hz – 25 Hz	20	$2 \times 10^4/f$	$2.5 \times 10^{-2}/f$
25 Hz – 300 Hz	$5 \times 10^2/f$	8×10^2	1×10^{-3}
300 Hz -3 kHz	$5 \times 10^2/f$	$2.4 \times 10^5/f$	$0.3/f$
3 kHz – 10 MHz	1.7×10^{-1}	80	1×10^{-4}
Notes:- f in Hz. - In the frequency range above 100 kHz, RF specific reference levels need to be considered additionally.			

Table 3 - ICNIRP 2010 Guidelines reference levels for **occupational** exposure to time-varying electric and magnetic fields (unperturbed rms values)

Frequency Range	E – Field Strength E ($kV\ m^{-1}$)	Magnetic Field Strength H ($A\ m^{-1}$)	Magnetic Flux Density B (T)
1 Hz – 8 Hz	5	$3.2 \times 10^4/f^2$	$4 \times 10^{-2}/f^2$
8 Hz – 25 Hz	5	$4 \times 10^3/f$	$5 \times 10^{-3}/f$
25 Hz – 50 Hz	5	1.6×10^2	2×10^{-4}
50 Hz -400 Hz	$2.5 \times 10^2/f$	1.6×10^2	2×10^{-4}

400 Hz – 3 kHz	$2.5 \times 10^2/f$	$6.4 \times 10^4/f$	$8 \times 10^{-2}/f$
3 kHz – 10 MHz	8.3×10^{-2}	21	2.7×10^{-5}
Notes: - f in Hz. - In the frequency range above 100 kHz, RF specific reference levels need to be considered additionally.			

Table 4 - ICNIRP 2010 Guidelines reference levels for **general public** exposure to time-varying electric and magnetic fields (unperturbed rms values)

Simultaneous Exposure to Multiple Frequency Fields (Total Exposure Quotients)

ICNIRP has specified a means of assessing additivity of exposures in situations of simultaneous exposure to fields of different frequencies. Additivity is examined separately for ICNIRP 2020 (thermal and other effects) and ICNIRP 2010 (electrical stimulation effects). As such, ICNIRP has set out basic restrictions which should be met for both considerations.

For practical application of the basic restrictions, ICNIRP has advised that the following criteria[15] regarding reference levels of field strengths should be applied.

Electromagnetic Fields (ICNIRP 2020)

For thermal considerations, relevant for frequencies above 100 kHz, measured levels for multiple fields of different frequencies must be additively assessed in accordance with the reference levels from the ICNIRP 2020 Guidelines as follows. And for calculations of practical applications of the whole-body average reference levels, incident electric field strength, incident magnetic field strength and incident power density values should be added accordingly with Table 1 or Table 2;

$$\sum_{i>100\ kHz}^{30\ MHz} MAX\left\{\left(\frac{E_{inc,i}}{E_{inc,RL,i}}\right)^2, \left(\frac{H_{inc,i}}{H_{inc,RL,i}}\right)^2\right\}$$
$$+ \sum_{i>30\ GHz}^{2\ GHz} MAX\left\{\left(\frac{E_{inc,i}}{E_{inc,RL,i}}\right)^2, \left(\frac{H_{inc,i}}{H_{inc,RL,i}}\right)^2, \left(\frac{S_{inc,i}}{S_{inc,RL,i}}\right)\right\}$$
$$+ \sum_{i>2\ GHz}^{300\ GHz} \left(\frac{S_{inc,i}}{S_{inc,RL,i}}\right) \leq 1$$

Where;

$E_{inc,i}$ and $E_{inc,RL,i}$ = are the whole-body average incident electric field strength and whole-body average incident electric field strength reference level given in **Error! Reference source not found.** at frequency i, respectively.

$E_{inc,i}(t)$ = is the whole-body average E_{inc} level over time t.

---

[15] *The calculated values are referred to as '**Total Exposure Quotients**' elsewhere in this report.*

$H_{inc,i}$ *and* $H_{inc,RL,i}$ = are the whole-body average incident magnetic field strength and whole-body average incident magnetic field strength reference level given in table **Error! Reference source not found.** at frequency i, respectively.
$H_{inc,i}(t)$ = is the whole-body average H_{inc} level over time t.

$S_{inc,i}$ *and* $S_{inc,RL,i}$ = and the whole-body average incident power density and whole-body average incident power density strength reference level given in table Table 1 - **ICNIRP 2020 Guidelines** reference levels for **occupational** exposure, averaged over 30 minutes and the whole body, to electromagnetic fields from 100 kHz to 300 GHz (unperturbed rms values)
at frequency i, respectively.
$S_{inc,i}(t)$ = is the whole-body average $S_{inc,i}$ level over time t.

Electrical Stimulation (ICNIRP 2010)

For electrical stimulation effects, relevant for frequencies up to 10 MHz, measured levels for multiple fields of different frequencies must be additively assessed in accordance with the reference levels from ICNIRP 2010 Guidelines as follows:

$$\sum_{j=1\ Hz}^{10\ MHz} \left(\frac{E_j}{E_{R,j}}\right) \leq 1,$$

And

$$\sum_{j=1\ Hz}^{10\ MHz} \left(\frac{H_j}{H_{R,j}}\right) \leq 1,$$

where

E_j = the electric field strength at frequency *j*;

$E_{R,\,j}$ = the electric field strength reference level at frequency j as given in Table 3 - **ICNIRP 2010 Guidelines** reference levels for **occupational** exposure to time-varying electric and magnetic fields (unperturbed rms values)

or Table 4 - **ICNIRP 2010 Guidelines** reference levels for **general public** exposure to time-varying electric and magnetic fields (unperturbed rms values)

;

H_j = the magnetic field strength at frequency j;

$H_{R,\,j}$ = the magnetic field strength reference level at frequency j as given in Table 3 - **ICNIRP 2010 Guidelines** reference levels for **occupational** exposure to time-varying electric and magnetic fields (unperturbed rms values)

or Table 4 - **ICNIRP 2010 Guidelines** reference levels for **general public** exposure to time-varying electric and magnetic fields (unperturbed rms values)

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APPENDIX 2 - GLOSSARY

Antenna: A conductive structure specifically designed to couple or to radiate electromagnetic energy.

BCCH: Broadcast control channel. BCCH is a constant carrier on GSM base stations. Essentially it is the 'always on' pilot channel. The constant signal level of the BCCH allows for extrapolation to a maximum traffic signal level for a base station.

Broadband Measurement: A measurement carried out using a meter and probe combination that simultaneously measures and sums all received signals within the frequency range of the probe. Generally this meter and probe combination is not as sensitive as the equipment used for narrowband measurements but is useful for getting an overall picture of the level of electromagnetic fields present at a site.

ComReg: the Commission for Communications Regulation. Established under the Communications Regulation Act 2002 (as amended), ComReg is the statutory body responsible for the regulation of the electronic communications sector (telecommunications, radiocommunications and broadcasting transmission) and the postal sector in Ireland.

Electric Field Strength: Electric field strength is a quantitative expression of the intensity of an electric field at a particular location. The standard unit is the volt per meter (V/m). A field strength of 1 V/m represents a potential difference of one volt between points separated by one meter.

Electromagnetic Field (EMF): Combined electric and magnetic fields, in this case radiating from an antenna.

Electromagnetic Spectrum: The complete range of the wavelengths of electromagnetic radiation, beginning with the radio waves and extending through microwaves and visible light (a very small part of the spectrum) all the way to the extremely short gamma rays that are a product of radioactive atoms. The electromagnetic spectrum contains both non-ionizing and ionizing radiation

Frequency: The number of cycles completed in one second by an electromagnetic wave. It is expressed in Hertz (Hz) or a multiple of Hertz, e.g. kHz (kilohertz, 1,000 Hertz), MHz (MegaHertz, 1,000,000 Hertz) and GHz (GigaHertz, 1,000,000,000 Hertz).

Frequency Range: A group of frequencies between a selected start and stop frequency. E.g. the frequency range of the FM broadcast band includes all frequencies between 88 and 108 MHz.

Frequency Selective Measurement: A measurement carried out using a receiver and an antenna which measures the received signal strength at specific frequencies. A spectrum analyser is usually used as the receiver, and a range of antennas is used which are suitable for reception of all the frequencies to be measured.

ICNIRP: the International Commission on Non-Ionising Radiation Protection.

Ionising radiation: Ionising radiation, also called radioactivity, includes electromagnetic radiation whose waves contain energy sufficient to overcome the binding energy of electrons in atoms or molecules, thus creating ions. It occurs at frequencies within the range of ultraviolet light and higher, and includes x-rays and gamma rays. The sources of EMFs measured in this survey do not produce any ionising radiation.

Isotropic probe: Receives electromagnetic signals regardless of polarisation or direction of travel. An isotropic probe is designed to give the same reading, no matter which way it is pointed.

Non-ionising radiation (NIR): Includes all radiations and fields of the electromagnetic spectrum that do not normally have sufficient energy to produce ionisation in matter; characterized by energy per photon less than approximately 12 electron Volts, wavelengths greater than 100 nm, and frequencies lower than 3×10^{15} Hz.

Occupational Exposure: All exposure to EMF experienced by individuals who are exposed under known conditions in the course of performing their work and who are trained to be aware of potential risk and to take appropriate precautions.

Public Exposure: All exposure to EMF experienced by members of the general public, excluding occupational exposure and exposure during medical procedures.

Primary Common Pilot Channel (P-CPICH): A downlink channel broadcast by UMTS Node-Bs (i.e. 3G base stations) with constant power. It allows extrapolation to a maximum traffic signal level for a UMTS channel.

Radio frequency spectrum: In physics the radio frequency spectrum is commonly defined as that part of the electromagnetic spectrum at frequencies between 3 kHz and 300 GHz.

Spectrum analyser: An instrument that displays signal amplitude (strength) as it varies by signal frequency. The frequency appears on the horizontal axis and the amplitude is displayed on the vertical axis. It can be set to sweep a frequency band where the amplitude of the received signals show up as spikes on the recorded trace.

APPENDIX 3 – Equipment Calibration Certificates

Narda Safety Test Solutions GmbH
Sandwiesenstrasse 7 - 72793 Pfullingen - Germany
Phone: +49 7121 9732 0 - Fax: +49 7121 9732 790

narda
Safety Test Solutions

Calibration Certificate

Narda Safety Test Solutions hereby certifies that the object referenced to this certificate has been calibrated by qualified personnel using Narda's approved procedures. The calibration was carried out in accordance with a certified quality management system which conformed to ISO 9001.

OBJECT	**Broadband Field Meter NBM-550**
MANUFACTURER	Narda Safety Test Solutions GmbH
PART NUMBER (P/N)	**2401/01**
SERIAL NUMBER (S/N)	**A-0068**
CUSTOMER	
CALIBRATION DATE (YYYY-MM-DD)	2023-05-23
RESULT ASSESSMENT	within specifications
AMBIENT CONDITIONS	Temperature: (23 ± 3) °C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	2401-8700-00A

ISSUE DATE: 2023-05-23
(YYYY-MM-DD)

Lorcan McAuley

CALIBRATED BY
M. Wittig

AUTHORIZED SIGNATORY

Figure 1. NBM-550 Calibration Certificate

Narda Safety Test Solutions GmbH
Sandwiesenstrasse 7 - 72793 Pfullingen - Germany
Phone: +49 7121 9732 0 - Fax: +49 7121 9732 790

narda
Safety Test Solutions

Calibration Certificate

Narda Safety Test Solutions GmbH hereby certifies that the referenced equipment has been calibrated by qualified personnel to Narda's approved procedures. The calibration was carried out within a certified quality management system conforming to ISO 9001.

OBJECT	Probe EF 0391, E-Field
MANUFACTURER	Narda Safety Test Solutions
PART NUMBER (P/N)	2402/01
SERIAL NUMBER (S/N)	A-0119
CUSTOMER	Lorcan McTurley
CALIBRATION DATE (YYYY-MM-DD)	2023-05-24
AMBIENT CONDITIONS	Temperature: (23 ± 3) °C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	2402-8701-00A

ISSUE DATE: 2023-05-24
(YYYY-MM-DD)

N. Gillhart
CALIBRATED BY
N. Gillhart

AUTHORIZED SIGNATORY

Figure 2. EF 0391 E-Field Probe Calibration Certificate

Narda Safety Test Solutions GmbH
Sandwiesenstrasse 7 - 72793 Pfullingen - Germany
Phone: +49 7121 9732 0 - Fax: +49 7121 9732 790

narda
Safety Test Solutions

Calibration Certificate

Narda Safety Test Solutions GmbH hereby certifies that the referenced equipment has been calibrated by qualified personnel to Narda's approved procedures. The calibration was carried out within a certified quality management system conforming to ISO 9001.

OBJECT	Probe EF 4091, E-Field
MANUFACTURER	Narda Safety Test Solutions
PART NUMBER (P/N)	2402/19B
SERIAL NUMBER (S/N)	A-0110
CUSTOMER	
CALIBRATION DATE (YYYY-MM-DD)	2023-05-24
AMBIENT CONDITIONS	Temperature: (23 ± 3) °C Relative humidity: (20 to 60) %
CALIBRATION PROCEDURE	2402-8704-00A

ISSUE DATE: 2023-05-24
(YYYY-MM-DD)

CALIBRATED BY
N. Gillhart

AUTHORIZED SIGNATORY

Figure 3. EF 4091 E-Field Probe Calibration Certificate

CERTIFICATE OF CALIBRATION

Certificate Number F15893A Issue Date: 23/05/2023

eurofins | ETC

Caddsdown Industrial Park, Clovelly Road, Bideford, Devon, EX39 3DX, United Kingdom
Tel: +44 (0) 1237 423388 | Web: www.etcal.co.uk | e-mail: enquiryetc@eurofins.com

ilac-MRA

UKAS CALIBRATION
0452

Customer Details

Customer
Compliance Engineering Ireland Ltd
Clonross Lane

Derrockstown
County Meath

Instrument Details

Description: Rohde & Schwarz FSH20 Handheld Spectrum Analyzer 9kHz to 20GHz

Serial Number: 120532
ID Number: 910

Date Received: 16 May 2023

Traceability

The following procedure(s) were used to perform the measurements.

Frequency
RF Intermodulation
RF Power
V Reflection Coeff.

Comments

Functional checks were performed prior to the measurements. No adjustments were made affecting the calibration. This certificate only relates to the items calibrated.

Calibrated 23 May 2023 by Steven Paul
PAT Tested 22 May 2023 by SP

APPROVED SIGNATORY
Oliver Sanders

Figure 4. FSH20 Calibration Certificate

Kiwa Dare Services
Calibrations

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. 0348 200 950
www.dare.nl
calibrations@dare.nl

CERTIFICATE OF CALIBRATION

For:	Compliance Engineering Ireland Ltd Clonross Lane Derrockstown Dunshaughlin Co Meath Ireland
On behalf of:	AMETEK (GB) Limited t/a NSI-MI UK Limited Stubley Lane S18 1Dj Dronfield
Instrument:	Horn Antenna manufacturer Emco type 3115 serial number 9905-5809 asset number 190001440
Calibration method:	The calibration has been carried out in a Full Anechoic Chamber simulating free space conditions according to the 3-antenna method as described in ANSI C63.5-2017. The path-attenuation from one antenna to another has been measured for 3 combinations of the antennas used. The Friis transmission formula and the measured attenuations have been used to calculate the Antenna Factors. During the antenna calibration, both antennas were positioned along the center line of the chamber. The distance between transmit and receive antenna was 3 m nominal, measured between the apertures of the antennas.
Ambient conditions:	The calibration was carried out at an ambient temperature of (23 ± 7)°C and a relative humidity of (50 ± 20)%.
Period of calibration:	2022 January, 21.
Results:	The results are listed on page 3 to 5. No adjustments have been made to the instrument. The measured values were calculated from a single sample.
Uncertainty:	The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02. The uncertainties refer to the measured values only with no account being taken of the ability of the instruments under test to maintain their calibration.

DARE!! Services B.V.
KVK Utrecht 30138675
Rabobank Utrechtse Waarden e.o.
IBAN: NL19RABO0168013704
SWIFT code: RABONL2U
EORI-nummer: NL805613488
Btw-nummer: NL805613488B01

Figure 5. 3115 Horn Antenna Calibration Certificate

Kiwa Dare

Vijzelmolenlaan 7
3447 GX Woerden
The Netherlands

Tel. +31 348 200 950
www.dare.nl
calibrations@dare.nl

CERTIFICATE OF CALIBRATION

For: Compliance Engineering Ireland Ltd
Clonross Lane Dunshaughlin
Co Meath
Ireland

On behalf of: AMETEK (GB) Limited t/a NSI-MI UK Limited
Stubley Lane
S18 1Dj Dronfield

Instrument: E-Field Probe + Readout unit

manufacturer	Narda
type	SRM-3501/02 + SRM-3001/01
serial number	H-0254 + M-0082
asset number	220000152

Calibration method: The calibration is carried out according to IEC 61000-4-3 :(2020-03).

The instrument was allowed to acclimatize for at least 2 hours before any measurements were made.

During calibration, all axis of the field probe are switched on as in the normal isotropic mode of operation of the probe.

Up to 150 MHz, the calibration is performed in a TEM cell. The calculated field method is used for the calibration. The polarization of the E-field is vertical.

The calibration of frequencies from 200 MHz is carried out in a full anechoic room. Over the frequency range of 200 MHz to 1000 MHz and above 18 GHz, the standard transfer method is used. For frequencies from 1200 MHz up to 18 GHz, the calculated field method is used. The polarization of the E-field is horizontal.

For each frequency and field strength setting, the field probe is rotated so that each position is aligned with the E-field. The position under test is always perpendicular to the direction of propagation and parallel to the E-field.

$$Correction\ Factor = \frac{Applied\ field\ strength}{Measured\ field\ strength}$$

The probe position has been determined as follows:

Figure 6. SRM-3000 & H-0254 Narda 3-Axis Antenna Calibration Certificate

Michael Kellner 947.

SEIBERSDORF LABORATORIES

Kalibrierstelle für Antennen und Feldsonden
Calibration Body for Antennas and Field Probes

Akkreditiert durch / *accredited by*
AKKREDITIERUNG AUSTRIA

Kalibrierschein nach ISO/IEC 17025
Calibration Certificate according to ISO/IEC 17025

Kalibrierzeichen
Calibration mark

EH-A902/20
0612
15.07.2020

Gegenstand *Object*	Tri Axis Probe
Hersteller & Typ *Manufacturer & Type*	Rohde & Schwarz TS-EMF-B1
Herstellernummer *Serial number*	100049
Auftraggeber *Customer*	Compliance Engineering Ireland Ltd. Clonross Lane Derrockstown Dunshaughlin A85 XN59 Co Meath IRELAND
Auftragsnummer *Order Nr.*	L L7.00059.0.0– A-7879_1 *Ext. Order Nr.: 2020/079*
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	1 - 6
Datum der Kalibrierung *Date of calibration*	15.07.2020

Akkreditierung Austria ist Vollmitglied bei der International Laboratory Accreditation Cooperation ILAC und Unterzeichner der MRAs für die Bereiche „Testing, Calibration and Inspection"

Die Kalibrierung erfolgt auf der gesetzlichen Grundlage des Akkreditierungsgesetzes in gültiger Fassung entsprechend den Anforderungen der OVE/ÖNORM EN ISO/IEC 17025

Dieser Kalibrierschein dokumentiert die Rückführbarkeit auf nationale Normale zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

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The calibration is performed in accordance with the Akkreditierungsgesetz in the amended version and the requirements of OVE/ÖNORM EN ISO/IEC 17025

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements according to the International System of Units (SI).

The user is obliged to have the object recalibrated at appropriate intervals.

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Datum *Date*	Zeichnungsberechtigter *Authorized person*	Bearbeiter *Person responsible*
17.07.2020	Patrick Preiner	Michael Klettner

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Figure 7. TS-EMF Antenna Calibration Certificate