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TEST REPORT

Report No.: 23080435HKG-001

Application For Original Grant of 47 CFR Part 15 Certification

Energybox Limited

FCC ID: 2AP8YEBPRO2

Prepared and Checked by:	Approved by:
Signed on File Leung Chun Ning, Peter Assistant Engineer	Digitally signed by Herbert Wong Location: Intertek Testing Services Hong Kong Limited Wong Cheuk Ho, Herbert Assistant Manager Date: June 12, 2024

TEST REPORT

GENERAL INFORMATION

Grantee:	Energybox Limited
Grantee Address:	Unit A1, 22/F., MG Tower, 133 Hoi Bun Road, Kwun Tong, Kowloon, Hong Kong.
FCC Specification Standard:	FCC Part 15, October 1, 2022 Edition
FCC ID:	2AP8YEBPRO2
FCC Model(s):	EB/PRO2-02
IC Specification Standard:	RSS-247 Issue 3, August 2023 RSS-Gen Issue 5 Amendment 2, February 2021
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	Smart Meter
Sample Receipt Date:	June 02, 2024
Date of Test:	June 02, 2024 to June 05, 2024
Report Date:	June 12, 2024
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 Certification.

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EXHIBIT 1 TEST RESULTS SUMMARY & STATEMENT OF COMPLIANCE

1.1 Summary of Test Results

Test Items	FCC Part 15 Section	Results	Details See Section
Antenna Requirement	15.203	Pass	2.1
Max. Conducted Output Power	15.247(b)(1) & (4)	Pass	4.1
Max. 20dB RF Bandwidth	N/A	N/A	4.2
Min. No. of Hopping Frequencies	15.247(a)(1)(iii)	Pass	4.3
Min. Hopping Channel Carrier Frequency Separation	15.247(a)(1)	Pass	4.4
Average Time of Occupancy	15.247(a)(1)(iii)	Pass	4.5
Out of Band Antenna Conducted Emission	15.247(d)	Pass	4.6
Radiated Emission in Restricted Bands and Spurious Emissions	15.247(d)	Pass	4.8
AC Power Line Conducted Emission	15.207 & 15.107	Pass	4.9

Note: Pursuant to FCC Part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

1.2 Statement of Compliance

The equipment under test is found to be complying with the following standards:

FCC Part 15, October 1, 2022 Edition

TEST REPORT

EXHIBIT 2 GENERAL DESCRIPTION

2.1 Product Description

The Equipment Under Test (EUT) is a 900MHz Transceiver for a Smart Meter. The sample supplied operated on 129 channels, normally at 902.2 - 927.8MHz. The channels are separated with 200kHz spacing. The EUT is powered by 120VAC.

The antenna(s) used in the EUT is external, detachable with reverse-SMA connector and the test sample is a prototype.
Maximum Antenna Gain: 3dBi

The circuit description and frequency hopping algorithm are attached in the Appendix and saved with filename: descri.pdf.

2.2 Test Methodology

Both AC power line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Preliminary radiated scans and all radiated measurements were performed in radiated emission test sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. Antenna port conducted measurements were performed according to ANSI C63.10 (2013) and KDB Publication No. 558074 D01 v05r02 (April 02, 2019). All other measurements were made in accordance with the procedures in 47 CFR Part 2 and RSS-Gen Issue 5 Amendment 2, February 2021.

2.3 Test Facility

The radiated emission test site, AC power line conducted measurement facility and antenna port conducted measurement facility used to collect the radiated data, AC Power Line conducted data, and conductive data are at Intertek Testing Services Hong Kong Ltd., which is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong SAR, China. This test facility and site measurement data have been fully placed on file with FCC and Industry Canada No.: 2042H, CABID is “HKAP01”.

2.4 Related Submittal Grants

This is a single application for certification of a transceiver.

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EXHIBIT 3 SYSTEM TEST CONFIGURATION

3.1 Justification

For radiated emissions testing, the equipment under test (EUT) was setup to transmit / receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables (if any) were manipulated to produce worst case emissions.

The EUT is powered by 120VAC.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable at 0.8m height from the ground plane for emission testing at or below 1GHz and 1.5m for emission measurements above 1GHz. If the base unit attached to peripherals, they were connected and operational (as typical as possible).

The signal was maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization were varied during the search for maximum signal level. The antenna height was varied from 1 to 4 meters. Radiated emissions were taken at three meters unless the signal level was too low for measurement at that distance. If necessary, a pre-amplifier was used and/or the test was conducted at a closer distance.

For any intentional radiator powered by AC power line, measurements of the radiated signal level of the fundamental frequency component of the emission was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

For transmitter radiated measurement, the spectrum analyzer resolution bandwidth was 100 kHz for frequencies below 1000 MHz. The resolution bandwidth was 3 MHz for frequencies above 1000 MHz.

Radiated emission measurement for transmitter were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Receiver was performed from 30MHz to the fifth harmonic of the highest frequency or 40GHz, whichever is lower.

Emission that are directly caused by digital circuits in the transmit path and transmitter portion were measured, and the limit are according to FCC Part 15 Section 15.209. Digital circuitries used to control additional functions other than the operation of the transmitter are subject to FCC Part 15 Section 15.109 Limits.

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3.1 Justification (Cont'd)

Detector function for radiated emissions was in peak mode. Average readings, when required, were taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 4.3.4.

Determination of pulse desensitization was made according to *Hewlett Packard Application Note 150-2, Spectrum Analysis... Pulsed RF.* The effective period (Teff) was referred to Exhibit 4.3.4. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

For AC line conducted emission test, the EUT along with its peripherals were placed on a 1.0m(W)x1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50ohm coupling impedance for measuring instrument. The LISN housing, measuring instrument case, reference ground plane, and vertical ground plane were bounded together. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were manipulated to find the maximum emission.

All relevant operation modes have been tested, and the worst-case data is included in this report.

There are 2 different configurations for this EUT, when the antenna is directly connected to the EUT and when it is connected to the EUT through an antenna base. All the data is shown in this report.

3.2 EUT Exercising Software

The EUT exercise program (Tera Terms Version 4.106) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

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3.3 Supporting Equipment List and Description

Description	Remark
Hub	Provided by Applicant
Extender (Energyspider 2, EB/SPI6-02)	Provided by Applicant
Current Sensor	Provided by Applicant

3.4 Measurement Uncertainty

Decision Rule for compliance: For FCC/IC standard, the measured value must be within the limits of applicable standard without accounting for the measurement uncertainty. For EN/IEC/HKTA/HKTC standard, conformity rules will be used as per standard directly excepted EN/IEC 61000-3-2, EN/IEC 61000-3-3, HKTA1004, HKCA1008, HKTA1019, HKTA1020, HKTA1041 and HKTA1044.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

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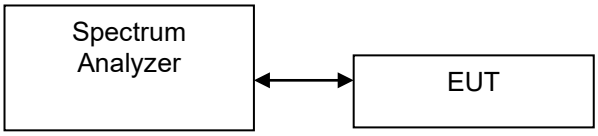
EXHIBIT 4 TEST RESULTS

1.1 Maximum Conducted (Peak) Output Power at Antenna Terminals

RF Conducted measurement Test Setup by a Spectrum Analyzer

The figure below shows the test setup, which is utilized to make these measurements.



☐ The antenna power of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

☒ The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for RBW>20dB bandwidth and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

Peak Antenna Gain = 3 dBi

Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 902.2	9.46	8.83
Middle Channel: 915.0	9.36	8.63
High Channel: 927.8	9.14	8.20

Cable loss: 0.5dB External Attenuation: 0dB

Cable loss, external attenuation: ☒ included in OFFSET function
☐ added to SA raw reading

dBm Max. Output Level = 9.46 dBm

Limits:

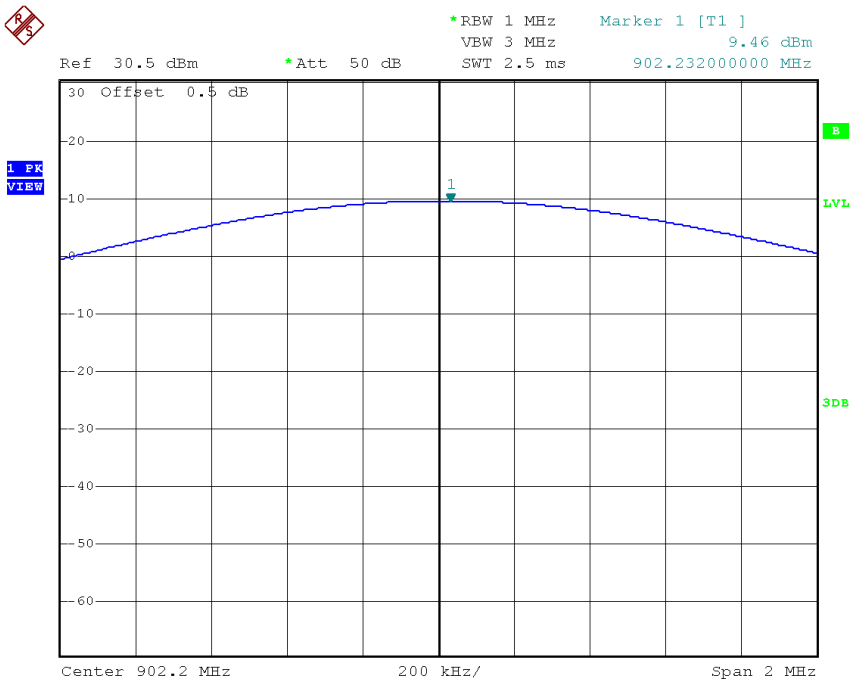
0.25W (23.98dBm) for antennas with gains of 6dBi or less.

The plots of conducted output power are saved as below.

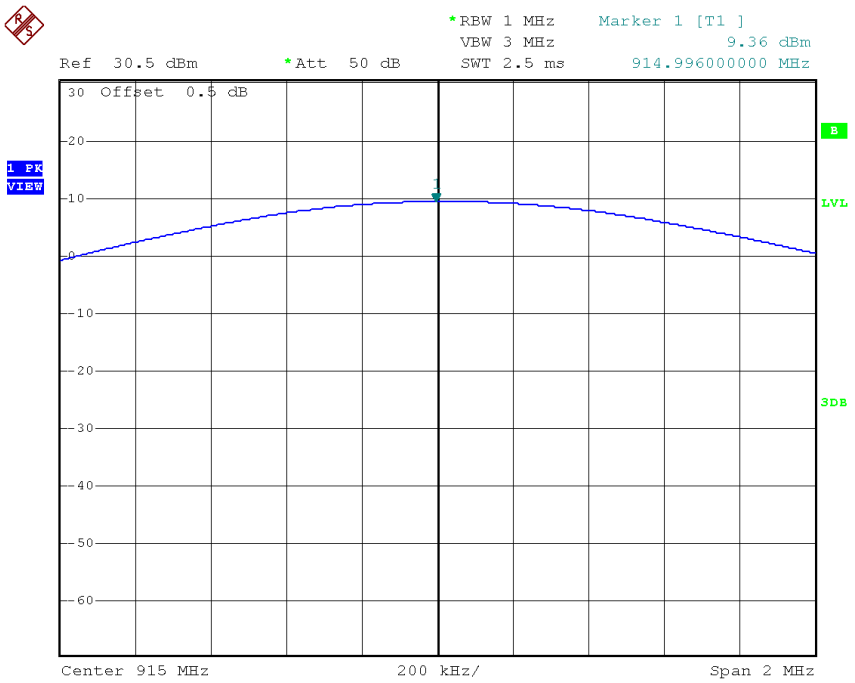
TEST REPORT

PLOTS OF CONDUCTED OUTPUT POWER

Lowest Channel



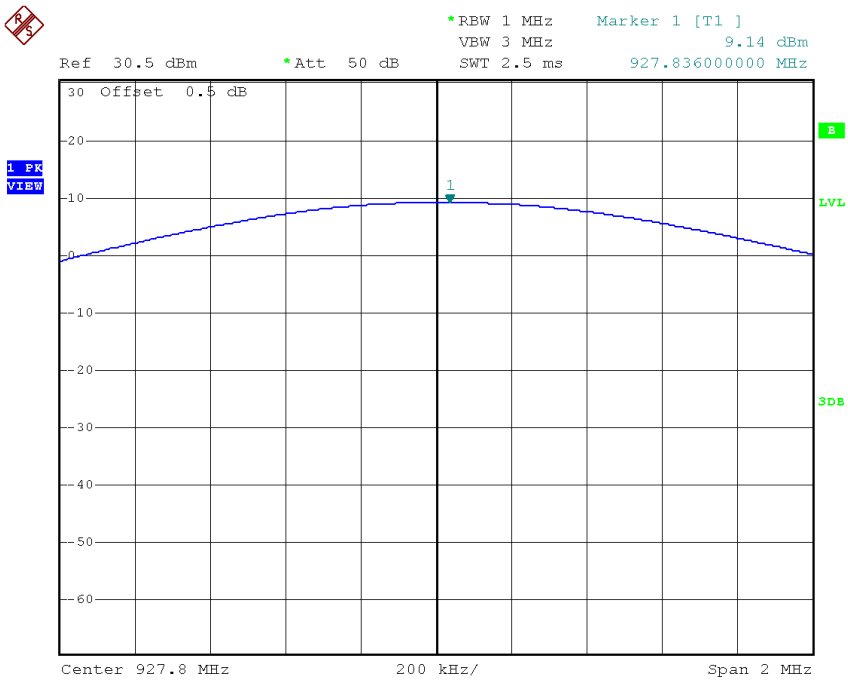
Middle Channel



TEST REPORT

PLOTS OF CONDUCTED OUTPUT POWER

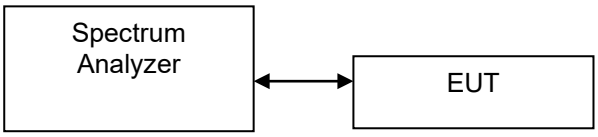
Highest Channel



TEST REPORT

4.2 Maximum 20dB RF Bandwidth

The figure below shows the test setup, which is utilized to make these measurements.



The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 20dB lower than PEAK level. The 20dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	20dB Bandwidth (kHz)
Low Channel: 902.2	105
Middle Channel: 915.0	106
High Channel: 927.8	106

Limits:

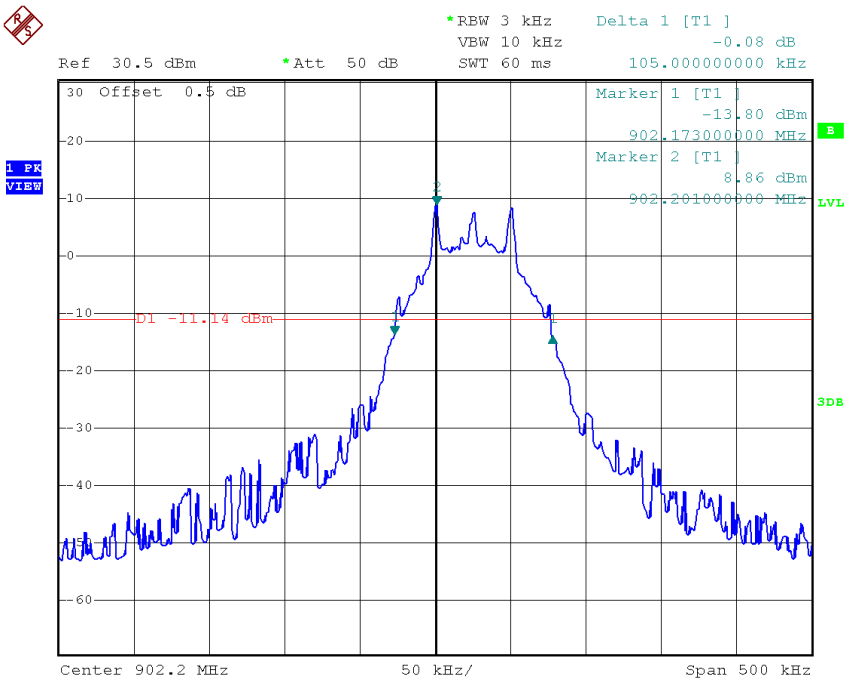
≤500kHz for 902-928MHz

The plots of 20dB RF bandwidth are saved as below.

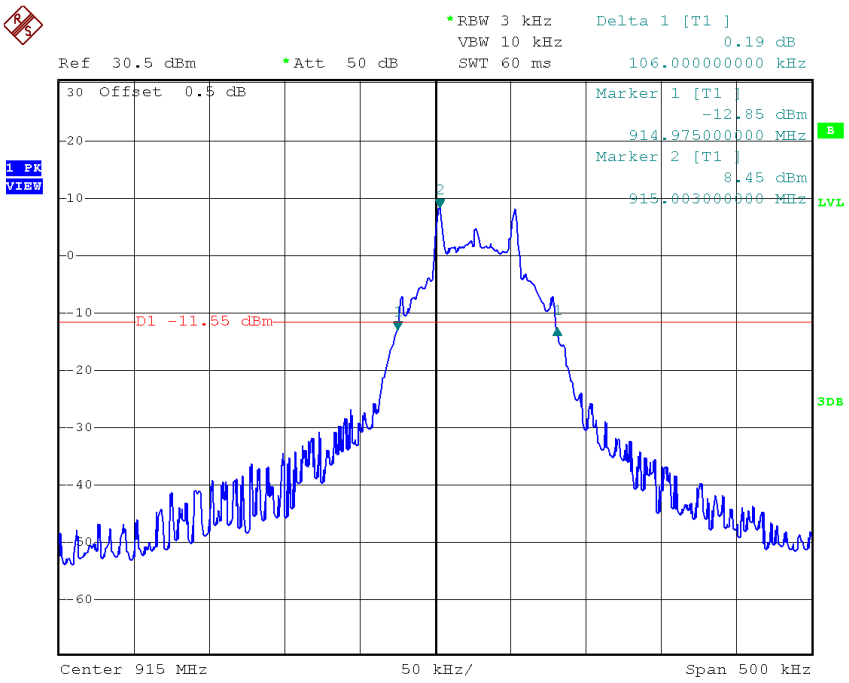
TEST REPORT

PLOTS OF 20dB RF BANDWIDTH

Lowest Channel



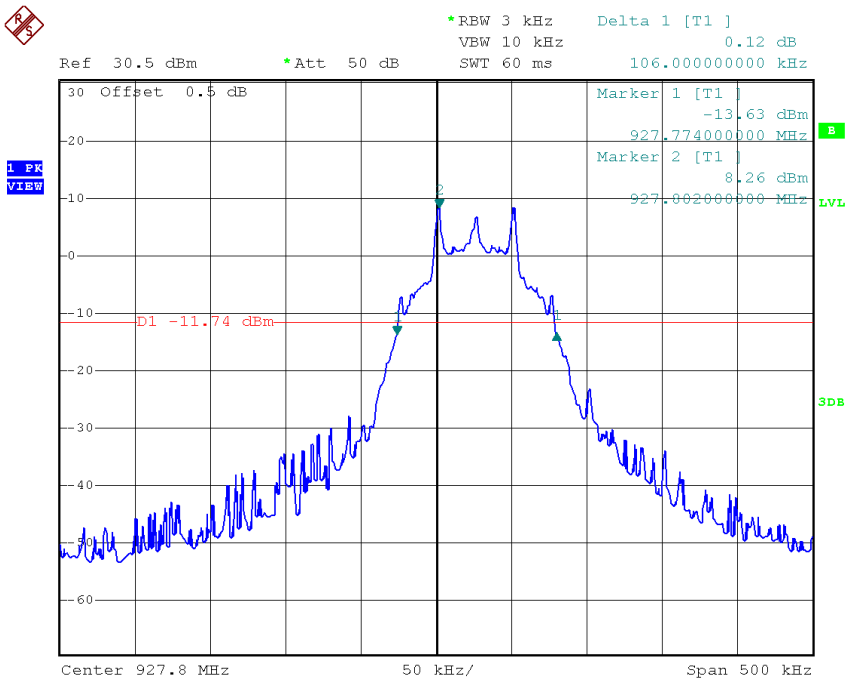
Middle Channel



TEST REPORT

PLOTS OF 20dB RF BANDWIDTH

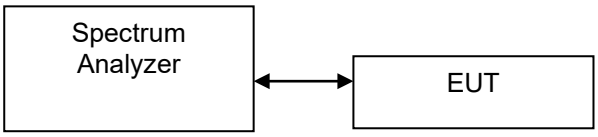
Highest Channel



TEST REPORT

4.3 Minimum Number of Hopping Frequencies

The figure below shows the test setup, which is utilized to make these measurements.



With the analyzer set to MAX HOLD readings were taken for 2-3 minutes in each band. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

No. of Hopping Channels:	129

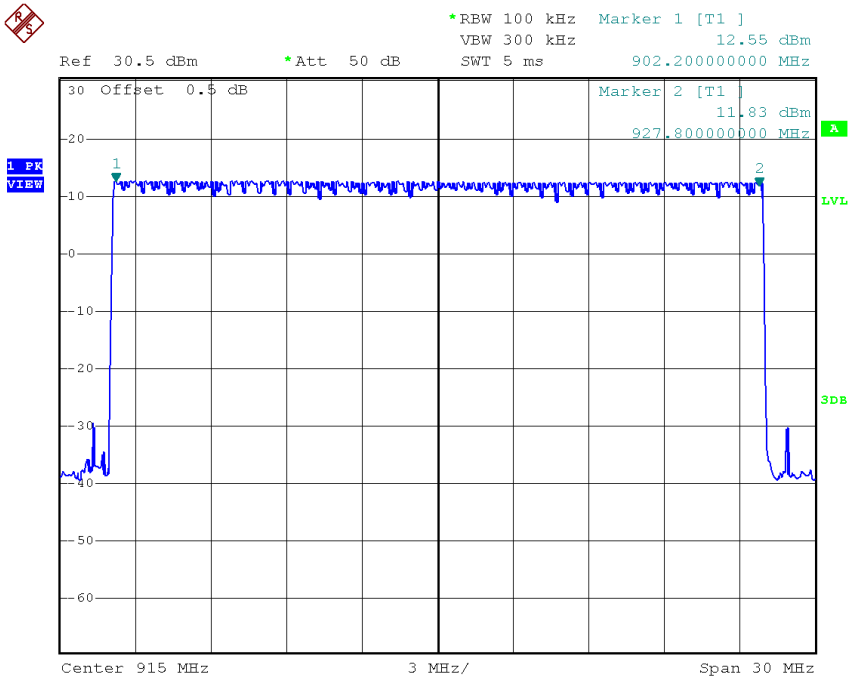
Minimum Requirements:

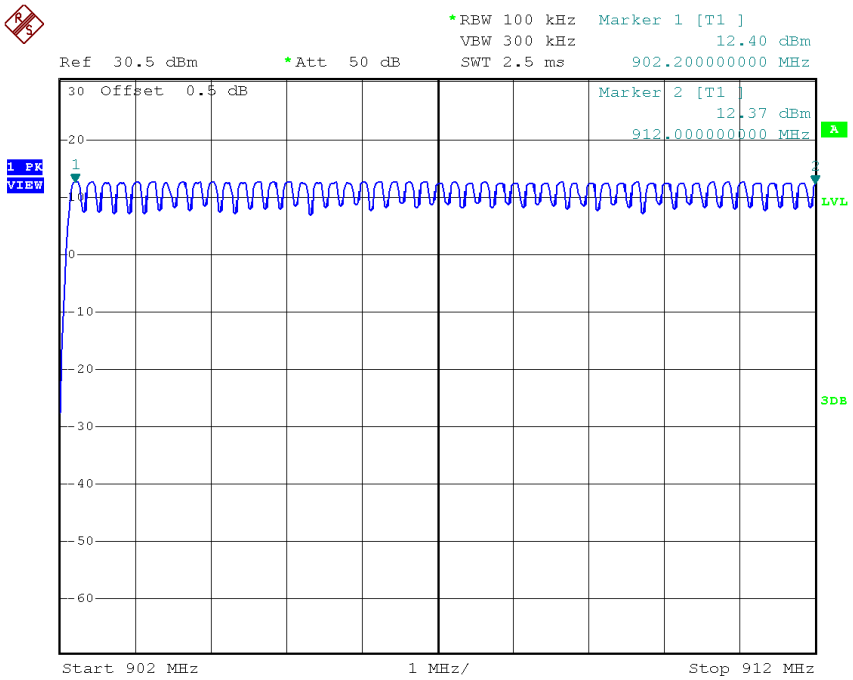
At least 50 hopping channels for 902MHz-928MHz (20 dB bandwidth of hopping channel < 250kHz)

The plots of number of hopping frequencies are saved as below.

TEST REPORT

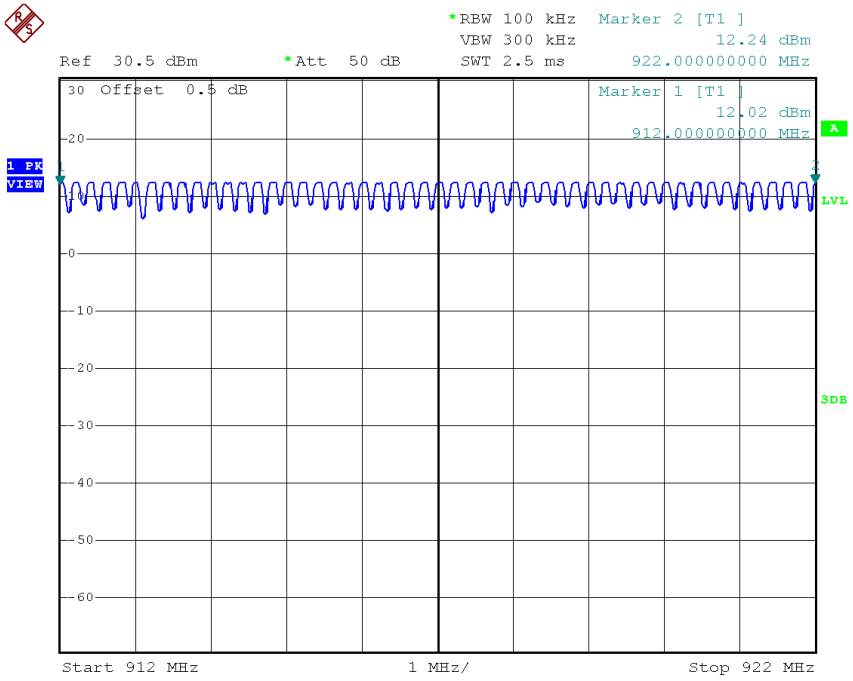
PLOTS OF NUMBER OF HOPPING FREQUENCIES

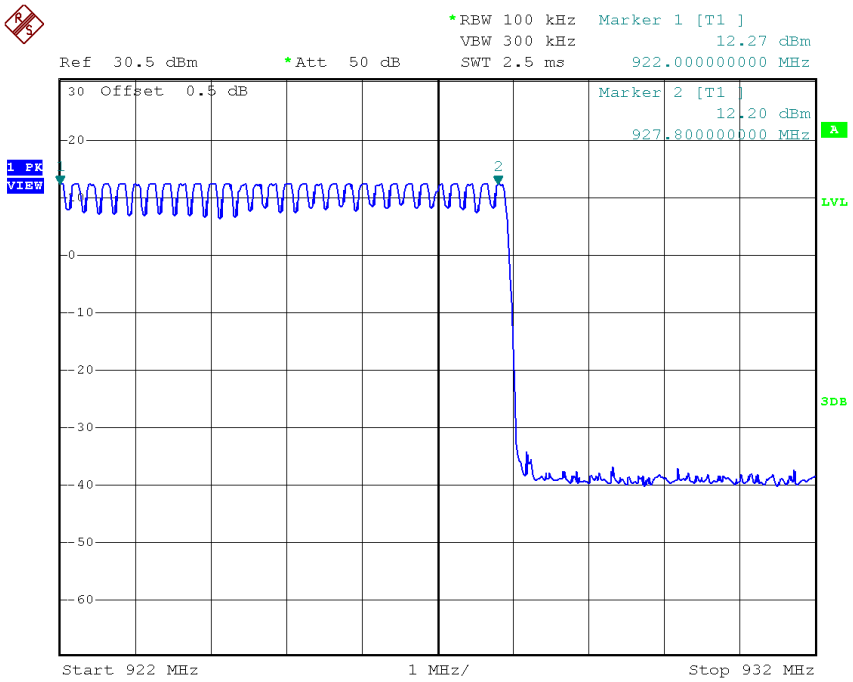




TEST REPORT

PLOTS OF NUMBER OF HOPPING FREQUENCIES

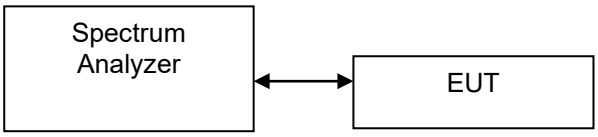




TEST REPORT

4.4 Minimum Hopping Channel Carrier Frequency Separation

The figure below shows the test setup, which is utilized to make these measurements.



Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and met the requirement.

Channel Separation (Channel 1 and Channel 2)	200kHz

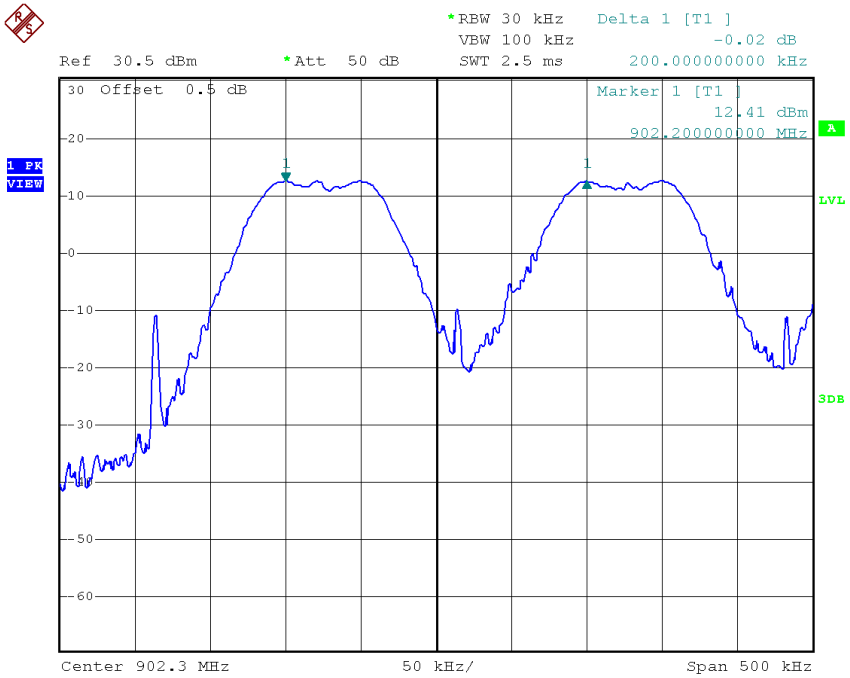
Limits:

The channel separation must be larger than:
20dB bandwidth of hopping channel: 106kHz

The plot(s) of hopping channel carrier frequency separation is saved as below.

TEST REPORT

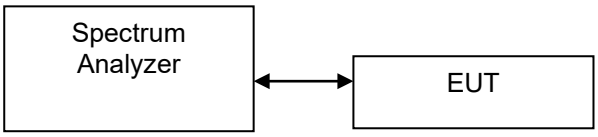
PLOTS OF HOPPING CHANNEL CARRIER FREQUENCY SEPARATION



TEST REPORT

4.5 Average Channel Occupancy Time

The figure below shows the test setup, which is utilized to make these measurements.



The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 1ms, the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

The SWEEP was then set to the time required by the regulation (20 seconds for 902-928 MHz devices, if the 20dB bandwidth is less than 250kHz, 10 seconds for 902-928 MHz if the 20dB bandwidth is or greater than 250kHz, "0.4 seconds x Number of hopping channels employed" seconds for 2400-2483.5 MHz, 30 seconds for 5725-5850 MHz). The analyzer was set to SINGLE SWEEP, the total ON time was added and compared against the limit (0.4 seconds).

Worst-Case	
Average Occupancy Time (Traffic – in a clear RF environment) =	10ms x 5 = 50ms

Limits:

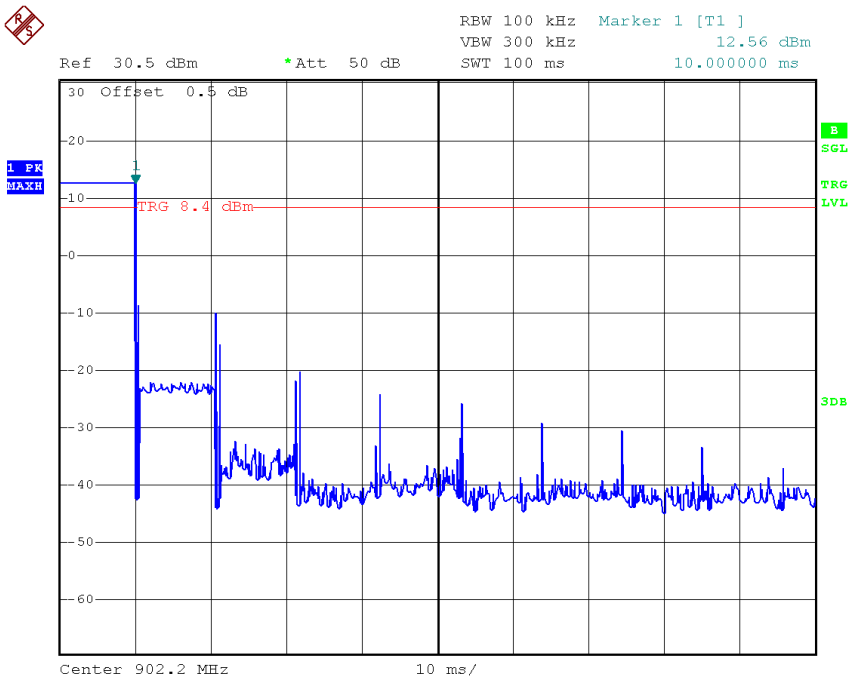
Average 0.4 seconds maximum occupancy in:
20 seconds for 902MHz-928MHz ≥ 50 hopping channels

The plots of average channel occupancy time are saved as below.

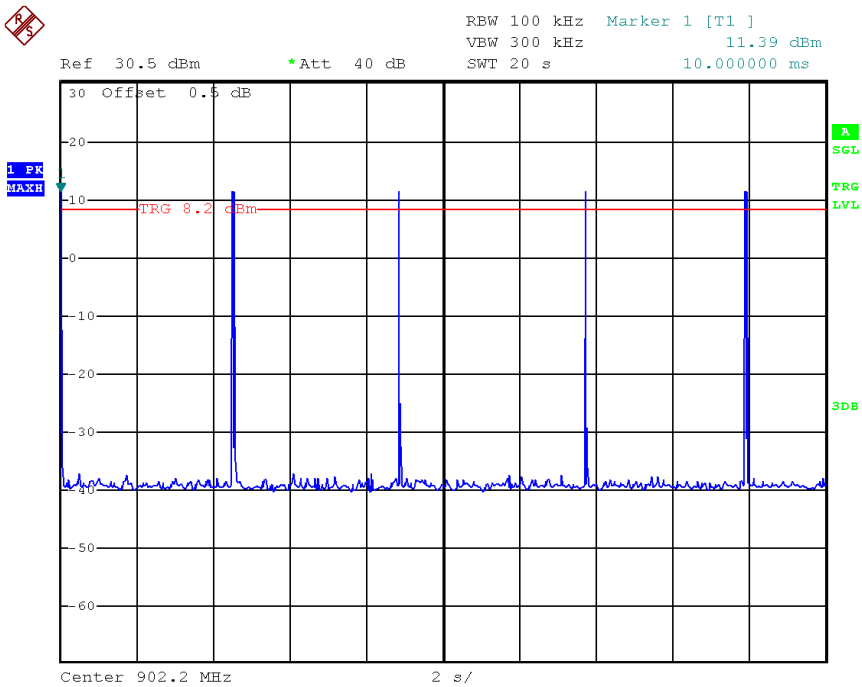
TEST REPORT

PLOTS AVERAGE CHANNEL OCCUPANCY TIME

Plot A



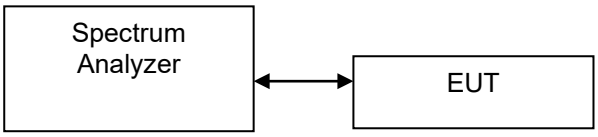
Plot B



TEST REPORT

4.6 Out of Band Conducted Emissions

The figure below shows the test setup, which is utilized to make these measurements.



In any 100kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20dB below that of the maximum in-band 100 kHz emission.

The plot(s) of bandedge compliance is shown the worst-case which has been already considered between enable and disable the hopping function of the EUT.

Limits:

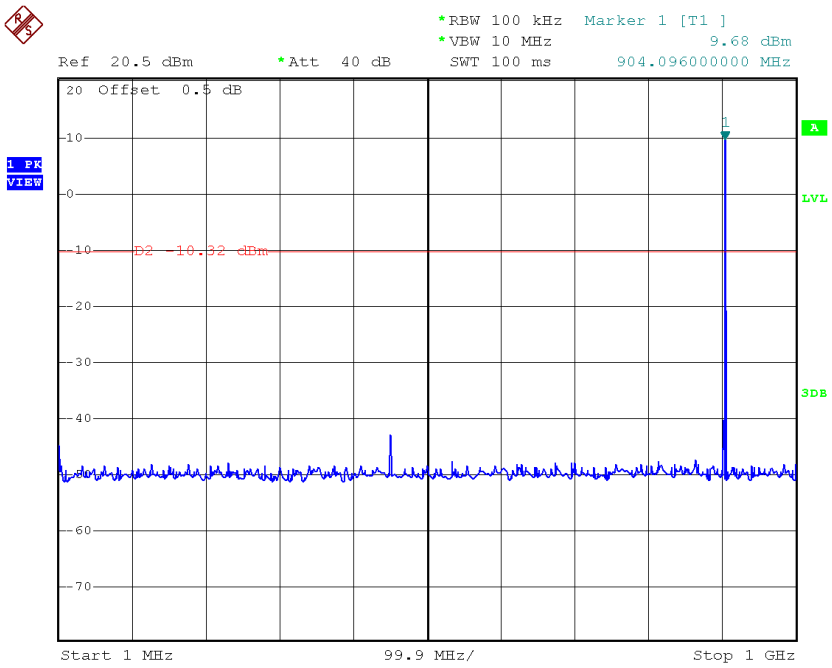
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

The plots of out of band conducted emissions and band edge are saved as below.

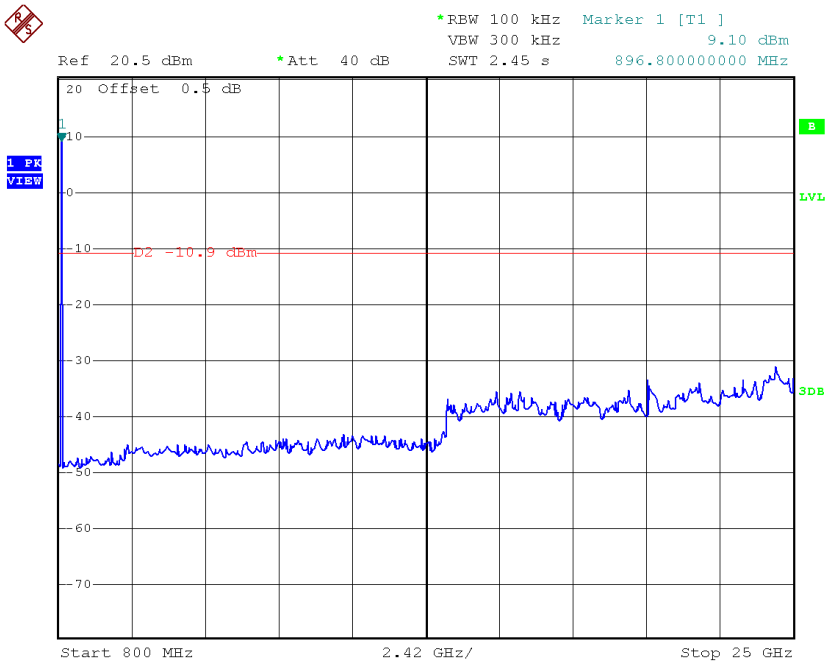
TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Lowest Channel, Plot 1



Lowest Channel, Plot 2



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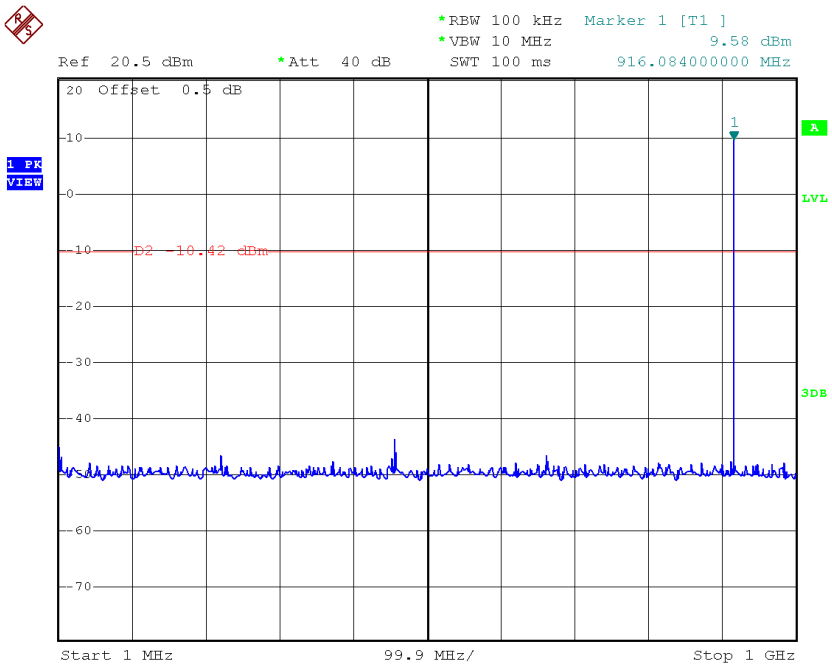
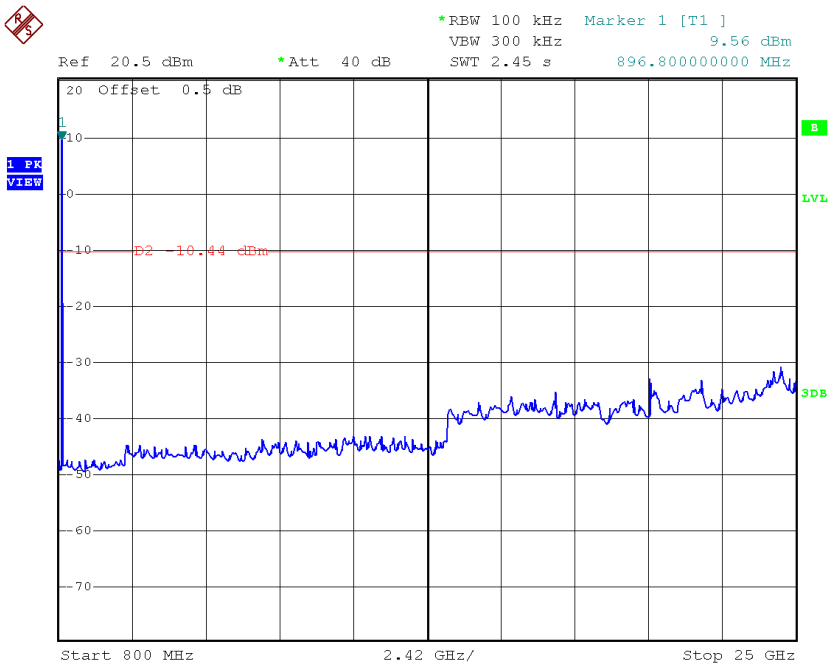
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Middle Channel, Plot 1



Middle Channel, Plot 2



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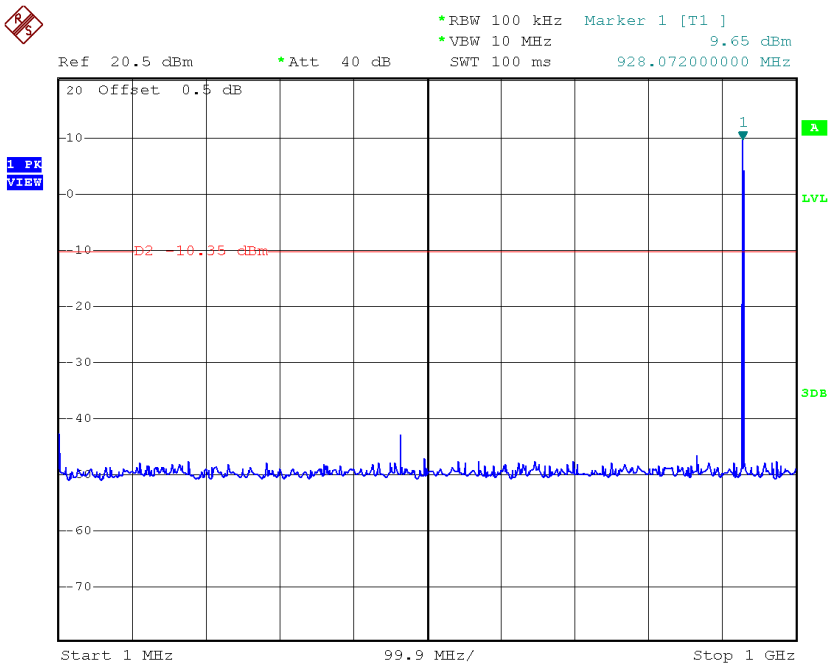
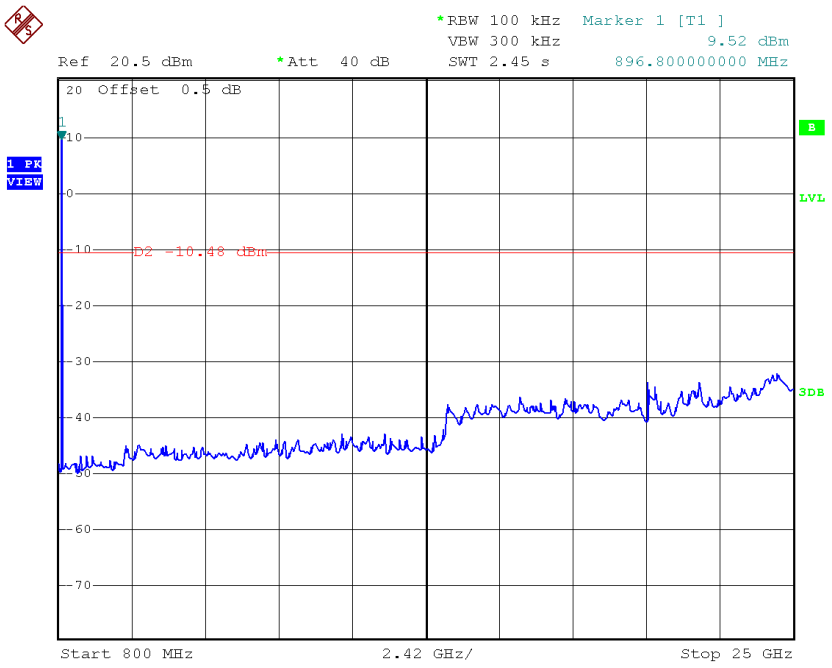
PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Highest Channel, Plot 1



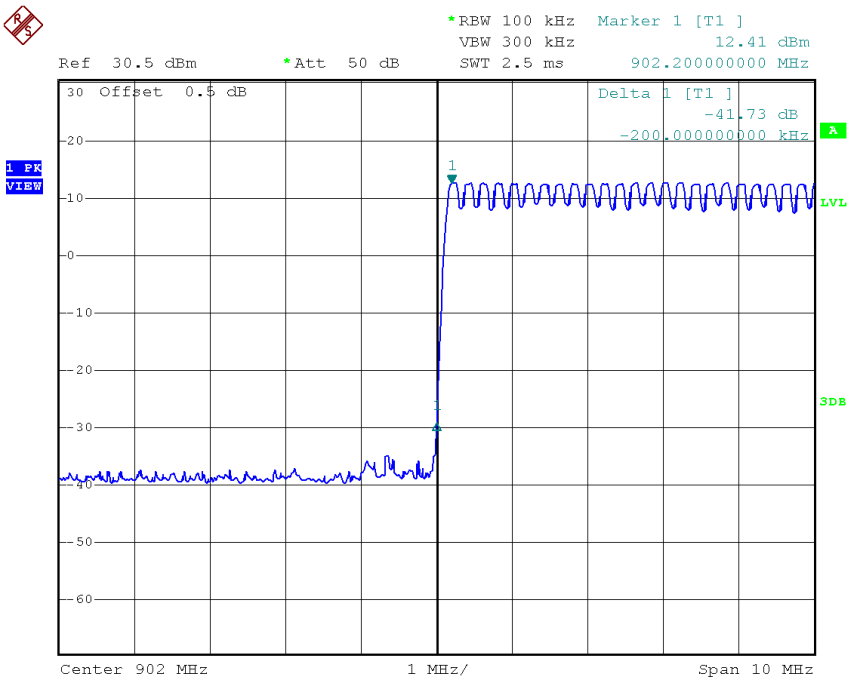
Highest Channel, Plot 2



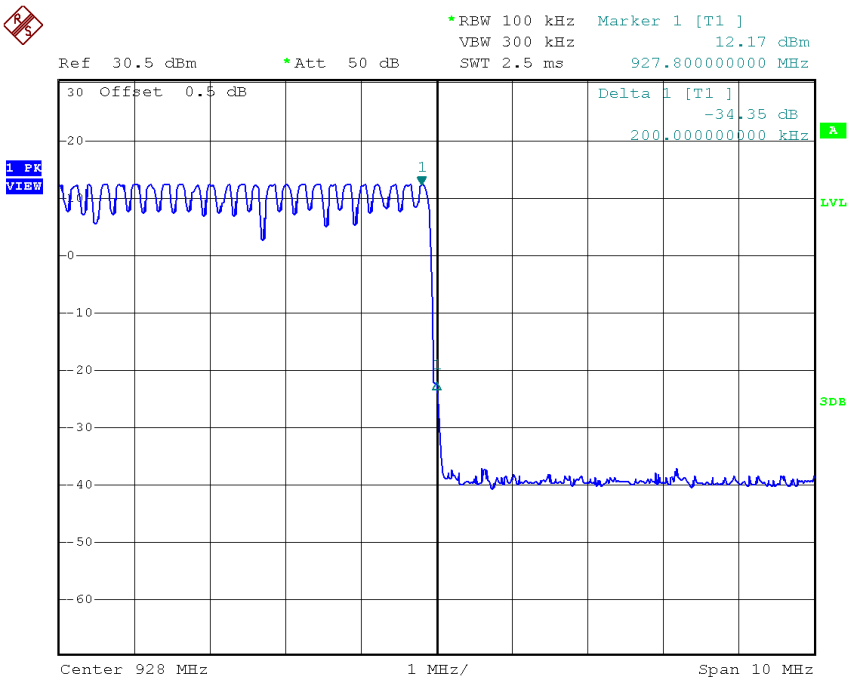
TEST REPORT

PLOTS OF BANDEDGE

Band Edge Low (Frequency Independent)



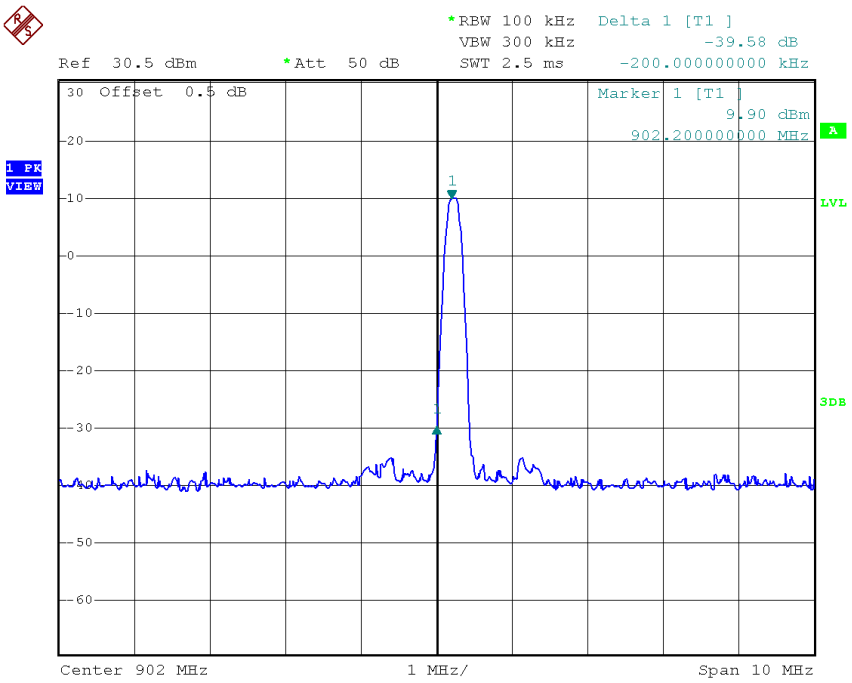
Band Edge High (Frequency Independent)



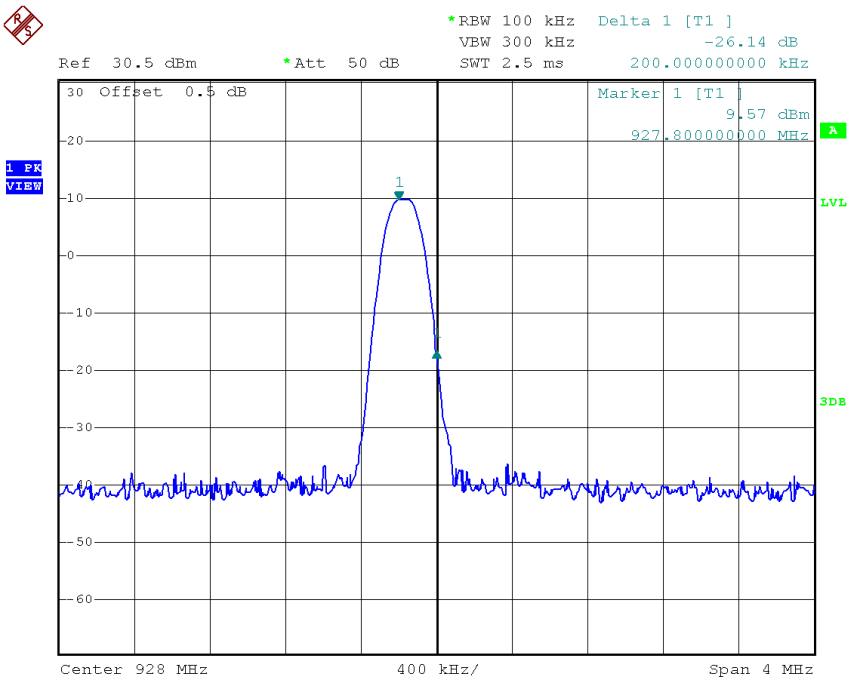
TEST REPORT

PLOTS OF BANDEDGE

Band Edge Low (Frequency Dependent)



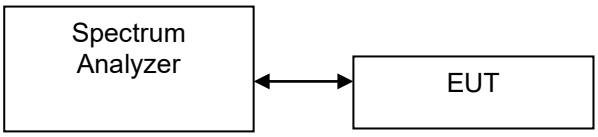
Band Edge High (Frequency Dependent)



TEST REPORT

OCCUPIED BANDWIDTH

The figure below shows the test setup, which is utilized to make these measurements.



Occupied Bandwidth Results:

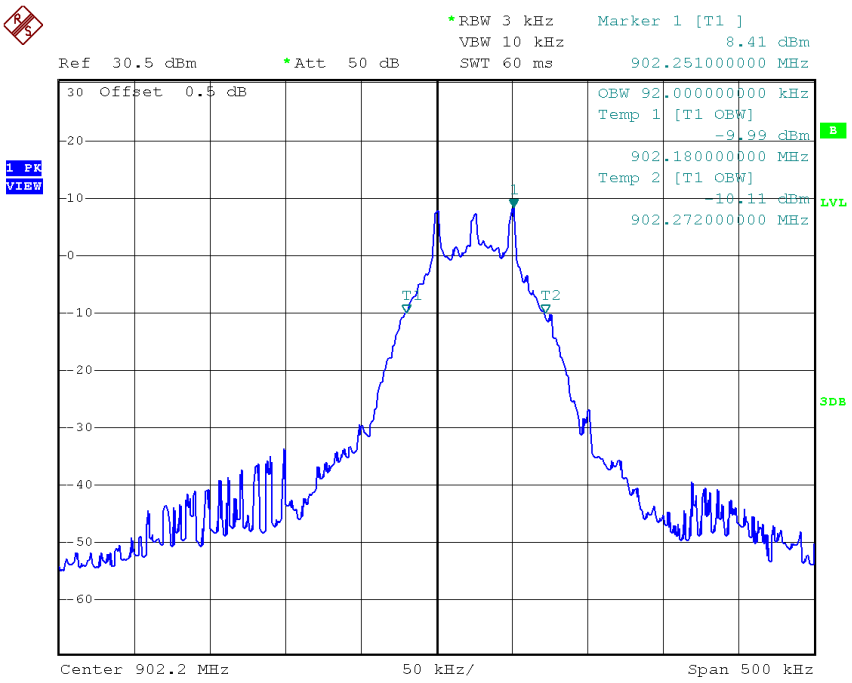
Frequency (MHz)	Occupied Bandwidth (kHz)
Low Channel: 902.2	92
Middle Channel: 915.0	98
High Channel: 927.8	100

The plots of occupied bandwidth are saved as below.

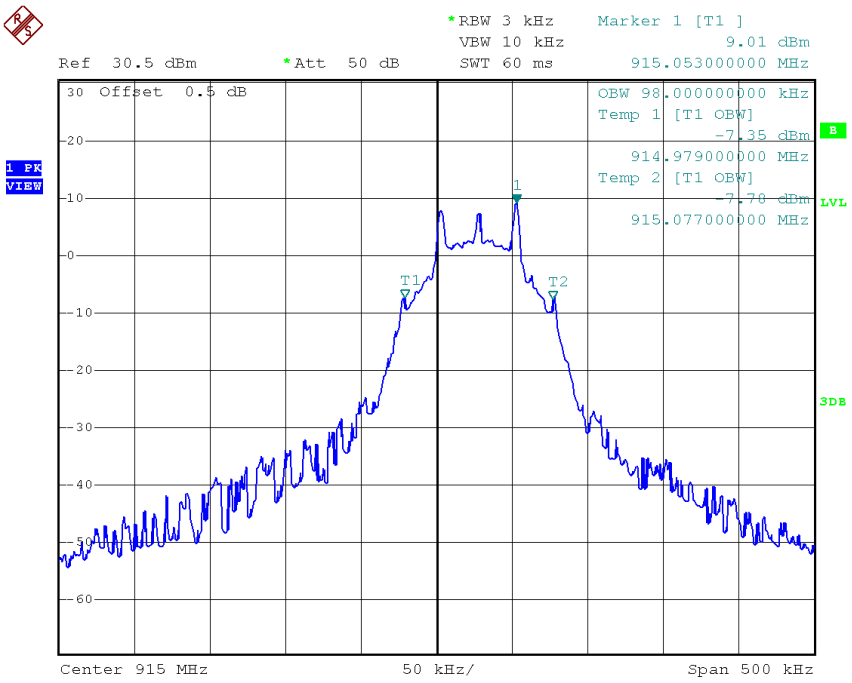
TEST REPORT

PLOTS OF OCCUPIED BANDWIDTH

Lowest Channel



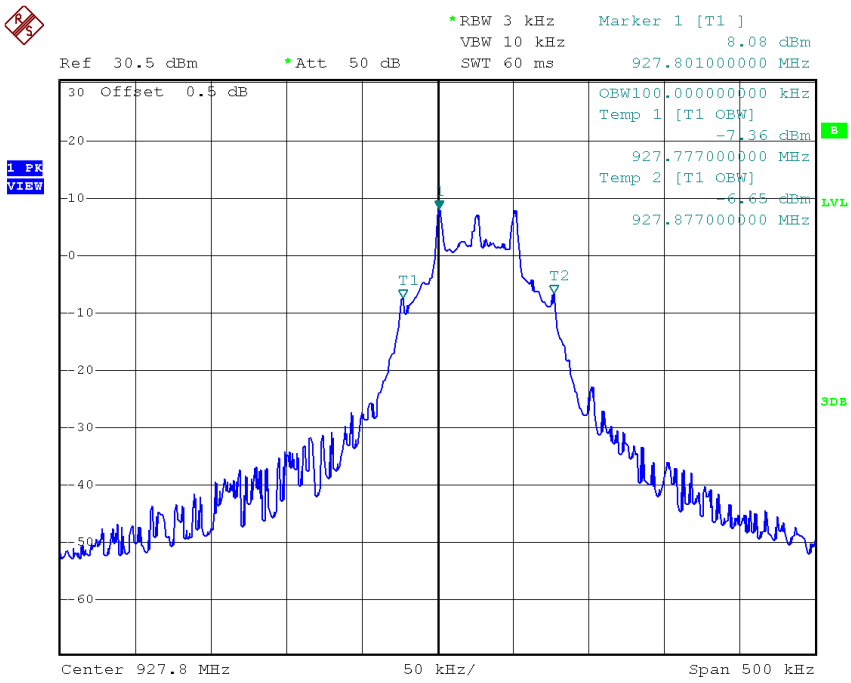
Middle Channel



TEST REPORT

PLOTS OF OCCUPIED BANDWIDTH

Highest Channel



TEST REPORT

4.7 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

where	FS	=	Field Strength in dBμV/m
	RA	=	Receiver Amplitude (including preamplifier) in dBμV
	CF	=	Cable Attenuation Factor in dB
	AF	=	Antenna Factor in dB
	AG	=	Amplifier Gain in dB
	PD	=	Pulse Desensitization in dB
	AV	=	Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflects the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Example:

Assume a receiver reading of 62.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted. The pulse desensitization factor of the spectrum analyzer is 0.0 dB, and the resultant average factor is -10.0 dB. The net field strength for comparison to the appropriate emission limit is 32.0 dBμV/m. This value in dBμV/m is converted to its corresponding level in μV/m.

RA	=	62.0 dBμV
AF	=	7.4 dB
CF	=	1.6 dB
AG	=	29 dB
PD	=	0.0 dB
AV	=	-10 dB
FS	=	62.0 + 7.4 + 1.6 – 29.0 + 0.0 + (-10.0) = 32.0 dBμV/m

Level in μV/m = Common Antilogarithm [(32.0 dBμV/m)/20] = 39.8 μV/m

TEST REPORT

4.8 Transmitter Radiated Emission and Spurious Emission

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.8.1 Radiated Emission Configuration Photograph

Worst Case Radiated Emission

928MHz

The worst case radiated emission configuration photographs are attached in the Appendix and saved with filename: setup photos.pdf

4.8.2 Radiated Emission Data

The data in tables 1-8 list the significant emission frequencies, the limit and the margin of compliance.

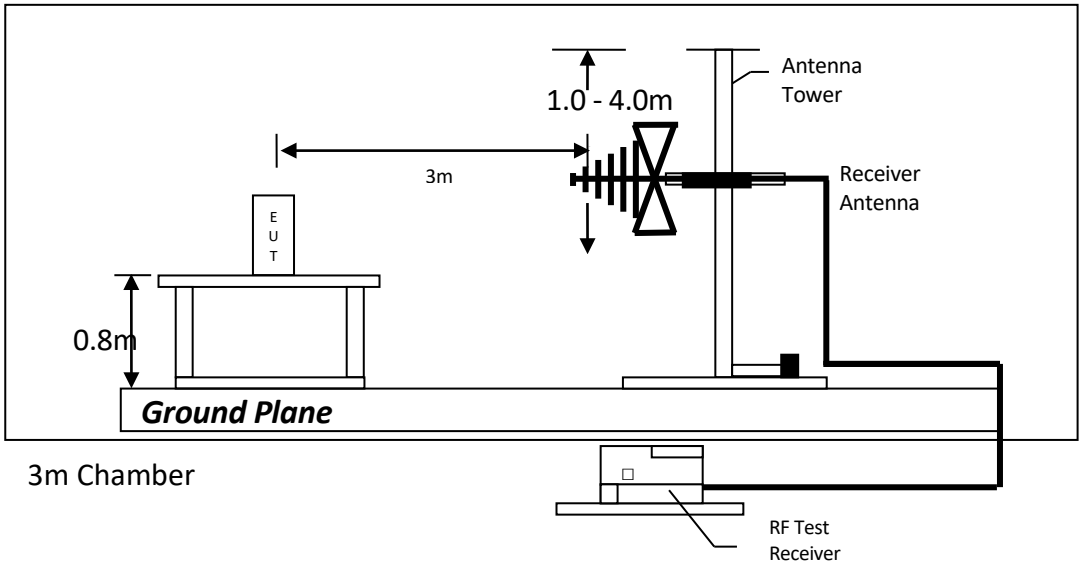
Judgement –

Passed by 0.5 dB

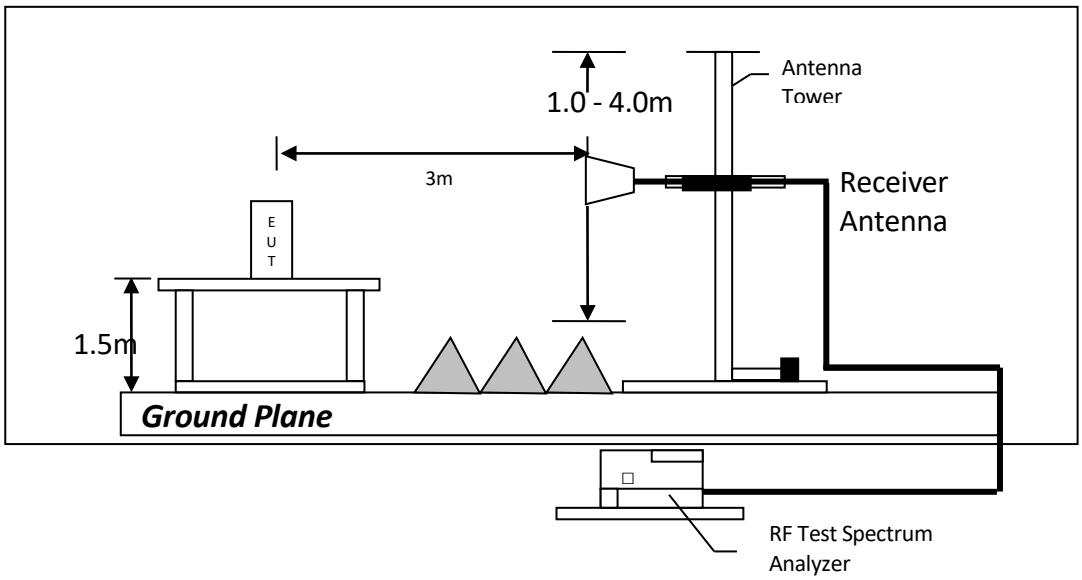
TEST REPORT

4.8.3 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 902.2 (Antenna only)

Table 1

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	1804.400	42.3	33	27.2	36.5	54.0	-17.5
H	2706.600	37.1	33	30.4	34.5	54.0	-19.5
H	3608.800	23.9	33	33.3	24.2	54.0	-29.8
V	4511.000	27.4	33	34.9	29.3	54.0	-24.7
H	5413.200	27.5	33	35.7	30.2	54.0	-23.8
V	6315.400	21.2	33	36.9	25.1	54.0	-28.9
H	7217.600	19.2	33	37.9	24.1	54.0	-29.9
V	8119.800	27.7	33	39.0	33.7	54.0	-20.3
H	9022.000	22.5	33	40.4	29.9	54.0	-24.1

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	1804.400	54.5	33	27.2	48.7	74.0	-25.3
H	2706.600	38.7	33	30.4	36.1	74.0	-37.9
H	3608.800	39.0	33	33.3	39.3	74.0	-34.7
V	4511.000	37.4	33	34.9	39.3	74.0	-34.7
H	5413.200	39.1	33	35.7	41.8	74.0	-32.2
V	6315.400	37.4	33	36.9	41.3	74.0	-32.7
H	7217.600	40.5	33	37.9	45.4	74.0	-28.6
V	8119.800	38.7	33	39.0	44.7	74.0	-29.3
H	9022.000	38.0	33	40.4	45.4	74.0	-28.6

NOTES:
1. Peak detector is used for the emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 915.0 (Antenna only)

Table 2

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	1830.000	40.5	33	27.2	34.7	54.0	-19.3
H	2745.000	37.2	33	30.4	34.6	54.0	-19.4
H	3660.000	27.3	33	33.3	27.6	54.0	-26.4
V	4575.000	32.1	33	34.9	34.0	54.0	-20.0
V	5490.000	23.3	33	35.7	26.0	54.0	-28.0
V	6405.000	26.5	33	36.9	30.4	54.0	-23.6
V	7320.000	28.3	33	37.9	33.2	54.0	-20.8
H	8235.000	26.0	33	39.0	32.0	54.0	-22.0
V	9150.000	24.8	33	40.4	32.2	54.0	-21.8

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	1830.000	47.1	33	27.2	41.3	74.0	-32.7
H	2745.000	41.5	33	30.4	38.9	74.0	-35.1
H	3660.000	37.4	33	33.3	37.7	74.0	-36.3
V	4575.000	35.9	33	34.9	37.8	74.0	-36.2
V	5490.000	37.4	33	35.7	40.1	74.0	-33.9
V	6405.000	36.5	33	36.9	40.4	74.0	-33.6
V	7320.000	39.8	33	37.9	44.7	74.0	-29.3
H	8235.000	38.0	33	39.0	44.0	74.0	-30.0
V	9150.000	38.8	33	40.4	46.2	74.0	-27.8

NOTES:
1. Peak detector is used unless otherwise stated.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 927.8 (Antenna only)

Table 3

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	1855.600	39.3	33	27.2	33.5	54.0	-20.5
H	2783.400	35.7	33	30.4	33.1	54.0	-20.9
H	3711.200	29.4	33	33.3	29.7	54.0	-24.3
V	4639.000	26.9	33	34.9	28.8	54.0	-25.2
H	5566.800	25.2	33	36.6	28.8	54.0	-25.2
H	6494.600	22.8	33	36.9	26.7	54.0	-27.3
H	7422.400	28.0	33	37.9	32.9	54.0	-21.1
V	8350.200	25.4	33	39.0	31.4	54.0	-22.6
V	9278.000	22.5	33	40.4	29.9	54.0	-24.1

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	1855.600	46.4	33	27.2	40.6	74.0	-33.4
H	2783.400	40.6	33	30.4	38.0	74.0	-36.0
H	3711.200	39.3	33	33.3	39.6	74.0	-34.4
V	4639.000	36.9	33	34.9	38.8	74.0	-35.2
H	5566.800	37.7	33	36.6	41.3	74.0	-32.7
H	6494.600	37.6	33	36.9	41.5	74.0	-32.5
H	7422.400	38.3	33	37.9	43.2	74.0	-30.8
V	8350.200	37.2	33	39.0	43.2	74.0	-30.8
V	9278.000	38.4	33	40.4	45.8	74.0	-28.2

NOTES:
1. Peak detector is used unless otherwise stated.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 902.2 (Antenna with base)

Table 4

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
V	1804.400	39.3	33	27.2	33.5	54.0	-20.5
V	2706.600	25.7	33	30.4	23.1	54.0	-30.9
H	3608.800	24.8	33	33.3	25.1	54.0	-28.9
V	4511.000	28.0	33	34.9	29.9	54.0	-24.1
V	5413.200	28.4	33	35.7	31.1	54.0	-22.9
H	6315.400	30.9	33	36.9	34.8	54.0	-19.2
H	7217.600	18.9	33	37.9	23.8	54.0	-30.2
H	8119.800	28.0	33	39.0	34.0	54.0	-20.0
H	9022.000	16.0	33	40.4	23.4	54.0	-30.6

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
V	1804.400	48.2	33	27.2	42.4	74.0	-31.6
V	2706.600	37.3	33	30.4	34.7	74.0	-39.3
H	3608.800	38.4	33	33.3	38.7	74.0	-35.3
V	4511.000	36.5	33	34.9	38.4	74.0	-35.6
V	5413.200	37.7	33	35.7	40.4	74.0	-33.6
H	6315.400	37.8	33	36.9	41.7	74.0	-32.3
H	7217.600	38.9	33	37.9	43.8	74.0	-30.2
H	8119.800	40.3	33	39.0	46.3	74.0	-27.7
H	9022.000	38.5	33	40.4	45.9	74.0	-28.1

NOTES:
1. Peak detector is used unless otherwise stated.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 915.0 (Antenna with base)

Table 5

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	1830.000	39.9	33	27.2	34.1	54.0	-19.9
V	2745.000	34.1	33	30.4	31.5	54.0	-22.5
V	3660.000	31.2	33	33.3	31.5	54.0	-22.5
V	4575.000	24.7	33	34.9	26.6	54.0	-27.4
V	5490.000	24.5	33	35.7	27.2	54.0	-26.8
H	6405.000	22.5	33	36.9	26.4	54.0	-27.6
V	7320.000	23.2	33	37.9	28.1	54.0	-25.9
V	8235.000	26.9	33	39.0	32.9	54.0	-21.1
V	9150.000	19.4	33	40.4	26.8	54.0	-27.2

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	1830.000	48.7	33	27.2	42.9	74.0	-31.1
V	2745.000	39.9	33	30.4	37.3	74.0	-36.7
V	3660.000	37.3	33	33.3	37.6	74.0	-36.4
V	4575.000	36.3	33	34.9	38.2	74.0	-35.8
V	5490.000	37.9	33	35.7	40.6	74.0	-33.4
H	6405.000	37.7	33	36.9	41.6	74.0	-32.4
V	7320.000	39.2	33	37.9	44.1	74.0	-29.9
V	8235.000	37.4	33	39.0	43.4	74.0	-30.6
V	9150.000	39.0	33	40.4	46.4	74.0	-27.6

NOTES:
1. Peak detector is used unless otherwise stated.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-Channel 927.8 (Antenna with base)

Table 6

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
H	1855.600	37.1	33	27.2	31.3	54.0	-22.7
H	2783.400	33.8	33	30.4	31.2	54.0	-22.8
H	3711.200	31.4	33	33.3	31.7	54.0	-22.3
H	4639.000	29.3	33	34.9	31.2	54.0	-22.8
H	5566.800	26.0	33	36.6	29.6	54.0	-24.4
H	6494.600	20.5	33	36.9	24.4	54.0	-29.6
H	7422.400	25.8	33	37.9	30.7	54.0	-23.3
V	8350.200	27.8	33	39.0	33.8	54.0	-20.2
V	9278.000	20.4	33	40.4	27.8	54.0	-26.2

Polari-zation	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
H	1855.600	46.3	33	27.2	40.5	74.0	-33.5
H	2783.400	38.1	33	30.4	35.5	74.0	-38.5
H	3711.200	37.0	33	33.3	37.3	74.0	-36.7
H	4639.000	36.6	33	34.9	38.5	74.0	-35.5
H	5566.800	37.6	33	36.6	41.2	74.0	-32.8
H	6494.600	36.8	33	36.9	40.7	74.0	-33.3
H	7422.400	39.7	33	37.9	44.6	74.0	-29.4
V	8350.200	38.4	33	39.0	44.4	74.0	-29.6
V	9278.000	38.4	33	40.4	45.8	74.0	-28.2

NOTES:
1. Peak detector is used unless otherwise stated.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Horn antenna is used for the emission over 1000MHz
6. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
7. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: Operating (Antenna only)

Table 7 (Quasi-Peak)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	100.797	39.8	16	12.0	35.8	43.5	-7.7
H	149.638	23.6	16	14.0	21.6	43.5	-21.9
H	170.408	22.6	16	18.0	24.6	43.5	-18.9
H	175.932	21.9	16	19.0	24.9	43.5	-18.6
H	181.152	23.8	16	20.0	27.8	43.5	-15.7
H	268.787	35.1	16	22.0	41.1	46.0	-4.9
V	902.000	28.5	16	32.0	44.5	46.0	-1.5
V	928.000	28.5	16	33.0	45.5	46.0	-0.5

NOTES:
1. Quasi-Peak detector is used for the emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
6. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

RADIATED EMISSION DATA

Mode: Operating (Antenna with base)

Table 8 Quasi-Peak

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Limit at 3m (dBµV/m)	Margin (dB)
V	100.810	35.7	16	12.0	31.7	43.5	-11.8
H	261.951	32.2	16	21.0	37.2	46.0	-8.8
H	268.256	32.9	16	22.0	38.9	46.0	-7.1
H	274.683	30.0	16	22.0	36.0	46.0	-10.0
V	470.380	25.6	16	26.0	35.6	46.0	-10.4
V	503.966	27.8	16	26.0	37.8	46.0	-8.2
V	902.000	28.0	16	32.0	44.0	46.0	-2.0
V	928.000	25.6	16	33.0	42.6	46.0	-3.4

NOTES:
1. Quasi-Peak detector is used for the emission measurement.
2. Average detector is used for the average data of emission measurement.
3. All measurements were made at 3 meters.
4. Negative value in the margin column shows emission below limit.
5. Emissions within the restricted band meets the requirement of FCC Part 15 Section 15.205
6. Measurement Uncertainty is ±5.3dB at a level of confidence of 95%.

TEST REPORT

4.9 AC Power Line Conducted Emission

EUT connects to AC power line. Emission Data is listed in following pages.

4.9.1 AC Power Line Conducted Emission Configuration Photograph

Worst Case Line-Conducted Configuration

at 0.681 MHz

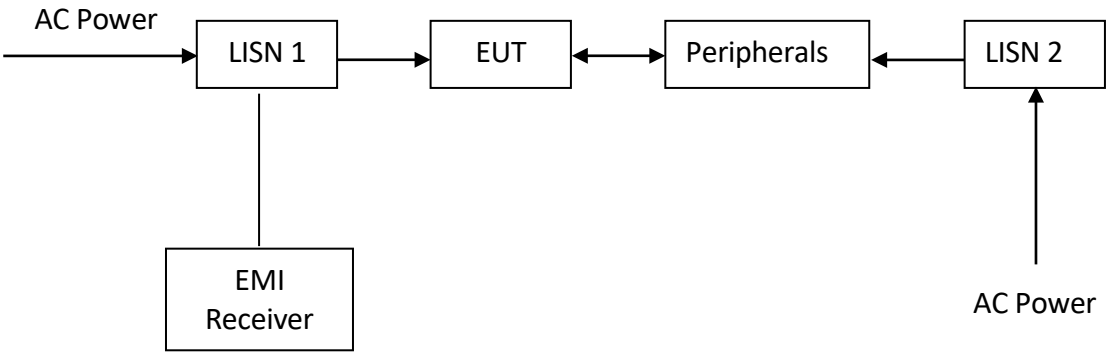
The worst-case line conducted configuration photographs are attached in the Appendix and saved with filename: setup photos.pdf.

4.9.2 AC Power Line Conducted Emission Data

The plot(s) and data in the following pages list the significant emission frequencies, the limit and the margin of compliance.

Passed by 5.3 dB margin compare with CISPR Average limit.

4.9.3 Conducted Emission Test Setup



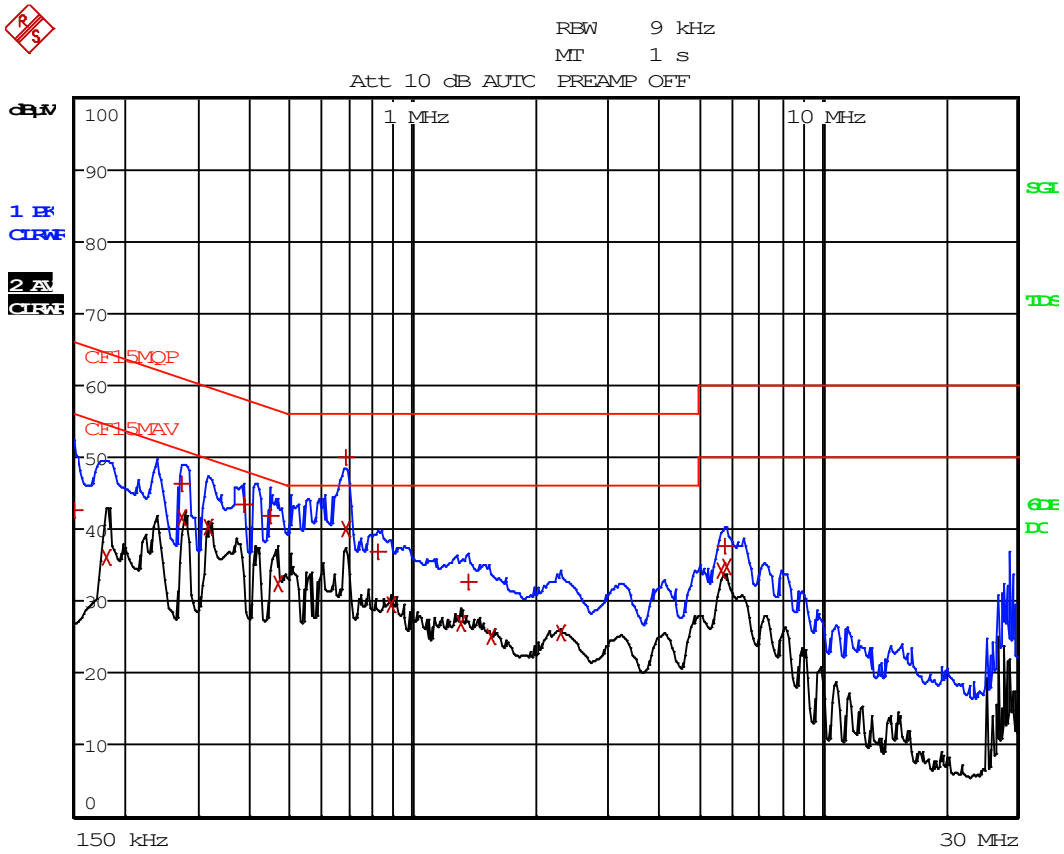
The EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were moved to find the maximum emission.

TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: Operating (Antenna only)



TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: Operating (Antenna only)

EDIT PEAK LIST (Final Measurement Results)

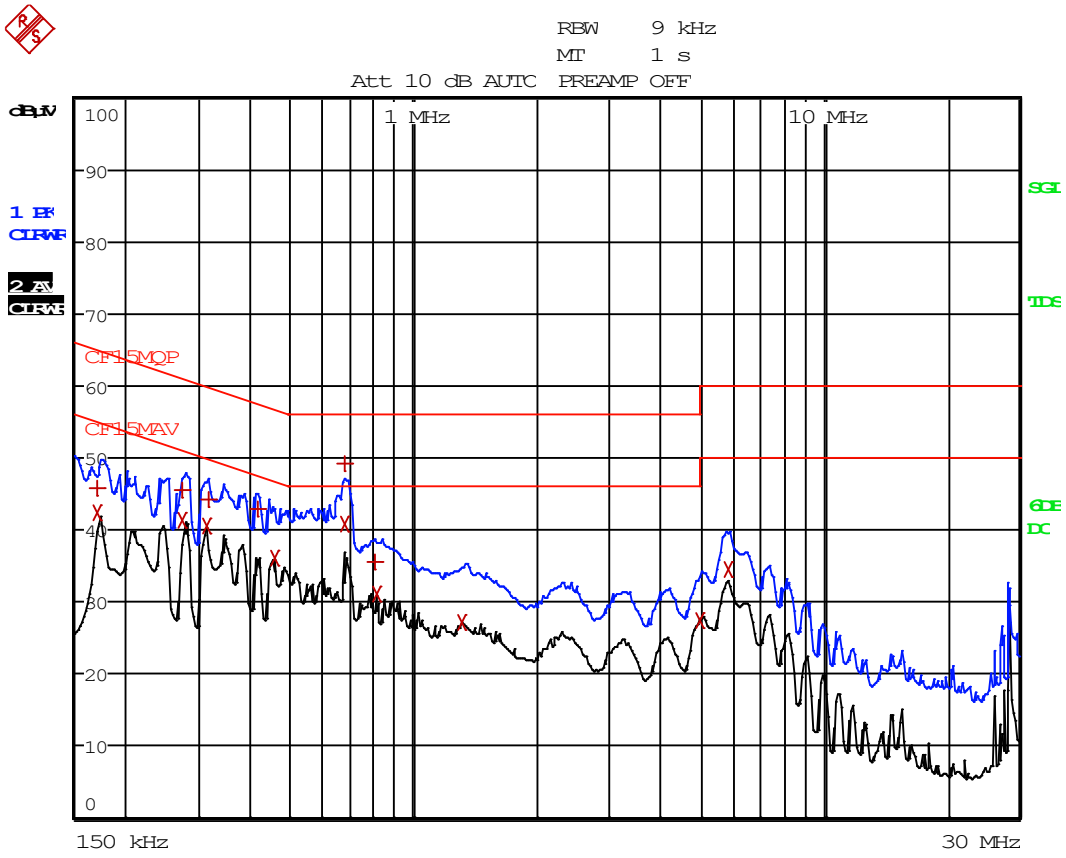
Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	150 kHz	42.65	N	-23.34
2	CISPR Average	181.5 kHz	35.96	L1	-18.45
1	Quasi Peak	276 kHz	46.29	L1	-14.64
2	CISPR Average	276 kHz	41.67	L1	-9.26
2	CISPR Average	316.5 kHz	40.32	L1	-9.46
1	Quasi Peak	384 kHz	43.44	L1	-14.74
1	Quasi Peak	447 kHz	41.75	L1	-15.17
2	CISPR Average	465 kHz	32.36	L1	-14.23
1	Quasi Peak	685.5 kHz	50.03	N	-5.96
2	CISPR Average	685.5 kHz	40.06	N	-5.94
1	Quasi Peak	825 kHz	36.94	L1	-19.05
2	CISPR Average	888 kHz	29.60	L1	-16.39
2	CISPR Average	1.3155 MHz	26.91	L1	-19.08
1	Quasi Peak	1.365 MHz	32.58	L1	-23.41
2	CISPR Average	1.5495 MHz	25.01	L1	-20.98
2	CISPR Average	2.3055 MHz	25.68	L1	-20.31
2	CISPR Average	5.694 MHz	34.34	N	-15.65
1	Quasi Peak	5.793 MHz	37.76	N	-22.23
2	CISPR Average	5.838 MHz	34.76	N	-15.23

TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: Operating (Antenna with base)



TEST REPORT

AC POWER LINE CONDUCTED EMISSION

Worst Case: Operating (Antenna with base)

EDIT PEAK LIST (Final Measurement Results)

Trace1: CF15MQP
Trace2: CF15MAV
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	172.5 kHz	45.72	L1	-19.11
2	CISPR Average	172.5 kHz	42.38	L1	-12.45
1	Quasi Peak	276 kHz	45.65	L1	-15.28
2	CISPR Average	276 kHz	41.24	L1	-9.69
2	CISPR Average	312 kHz	40.49	L1	-9.42
1	Quasi Peak	316.5 kHz	44.12	L1	-15.67
1	Quasi Peak	415.5 kHz	42.82	L1	-14.71
2	CISPR Average	456 kHz	35.98	L1	-10.77
1	Quasi Peak	681 kHz	49.25	N	-6.74
2	CISPR Average	681 kHz	40.74	N	-5.25
1	Quasi Peak	802.5 kHz	35.53	L1	-20.46
2	CISPR Average	816 kHz	30.98	L1	-15.01
2	CISPR Average	1.3065 MHz	27.04	L1	-18.95
2	CISPR Average	4.9875 MHz	27.35	L1	-18.64
2	CISPR Average	5.8695 MHz	34.57	N	-15.42

TEST REPORT

EXHIBIT 5 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver (9kHz to 26.5GHz)	Biconical Antenna (30MHz to 300MHz)	Log Periodic Antenna
Registration No.	EW-3156	EW-3242	EW-3243
Manufacturer	ROHDESCHWARZ	EMCO	EMCO
Model No.	ESR26	3110C	3148B
Calibration Date	January 31, 2024	April 26, 2022	October 30, 2022
Calibration Due Date	January 31, 2025	July 26, 2024	July 30, 2024

Equipment	Double Ridged Guide Antenna (1GHz - 18GHz)	Active Loop Antenna (H-field) (9kHz to 30MHz)	RF Preamplifier (9kHz to 6000MHz)
Registration No.	EW-0194	EW-3326	EW-3006b
Manufacturer	EMCO	EMCO	SCHWARZBECK
Model No.	3115	6502	BBV9718
Calibration Date	May 10, 2023	January 05, 2024	October 20, 2023
Calibration Due Date	November 10, 2024	July 05, 2025	October 20, 2024

Equipment	14m Double Shield RF Cable (9kHz - 6GHz)	RF Cable 14m (1GHz to 26.5GHz)	12 metre RF Cable (1-40)GHz
Registration No.	EW-2376	EW-2781	EW-2774
Manufacturer	RADIALL	GREATBILLION	GREATBILLION
Model No.	n m/br56/bnc m 14m	SMA m/SHF5MPU /SMA m ra14m,26G	SMA m-m ra 12m 40G outdoor
Calibration Date	September 19, 2023	January 16, 2024	January 16, 2024
Calibration Due Date	September 19, 2024	January 16, 2025	January 16, 2025

Equipment	Pyramidal Horn Antenna
Registration No.	EW-0905
Manufacturer	EMCO
Model No.	3160-09
Calibration Date	December 15, 2023
Calibration Due Date	June 15, 2025

TEST REPORT

5.0 EQUIPMENT LIST (CONT'D)

2) Conducted Emissions Test

Equipment	RF Cable 240cm (RG142) (9kHz to 30MHz)	Artificial Mains Network	EMI Test Receiver (9kHz to 3GHz)
Registration No.	EW-2454	EW-3360	EW-3095
Manufacturer	RADIALL	ROHDESCHWARZ	ROHDESCHWARZ
Model No.	Bnc m st / 142 / bnc mra 240cm	ENV-216	ESCI
Calibration Date	June 13, 2023	April 07, 2024	January 18, 2024
Calibration Due Date	June 13, 2024	April 07, 2025	January 18, 2025

3) Conductive Measurement Test

Equipment	EMI Test Receiver (9kHz to 26.5GHz)
Registration No.	EW-3156
Manufacturer	ROHDESCHWARZ
Model No.	ESR26
Calibration Date	January 31, 2024
Calibration Due Date	January 31, 2025

4) Control Software for Radiated Emission

Software Information	
Software Name	EMC32
Manufacturer	ROHDESCHWARZ
Software version	10.50.40 & 10.40.10

END OF TEST REPORT